AUGUST 7, 1950
American Machinist
MAGAZINE OF METALWORKING PRODUCTION
Checking pump bodies - see page 2
More on High-Speed Machining
How to Repair Forging Dies

who's the boss of this plant?

YOU ARE!

Yes — it's quite an organization you've got working for you here at The Heald Machine Company. In fact it's one of the most modern and efficient plants in the machine tool industry. And you are the boss — in more ways than one.

This entire plant was built and organized for *your benefit*. Its unequalled facilities for the production of precision finishing machines are at *your service*. Our staff of skilled engineers is always ready to help you on *your production problems*.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Checking . . . Our cover Kodachrome shows an inspector conducting a precision check on a production lot of pump bodies. The Pratt & Whitney Electrolimit external comparator determines accuracy for diameter, roundness, and straightness. Magnification can be as high as 20,000 to 1, and the gage is set to a stack of precision gage blocks for each dimension checked.

Special Special . . . Our Special Report in this issue is really two—one on high-speed machining, one on machine-tool productivity increases during the last ten years. The first is a further compendium of latest advances in surface speeds, or of feeds on tough materials, plus sketches of some typical tools. The emphasis is on drilling.

Some months ago, we addressed to machine-tool builders a letter asking the productivity of their 1950 units compared with those of 1940. Their letters added much flesh to what might have been a statistical skeleton, so we put the material into eight compact pages, with an estimate of America's losses in using obsolete equipment. We figure it at a billion dollars a year in labor cost alone—wasted by continued use of older models of machines. And that's only the most spectacular loss . . .

Shorts . . . We have a spread of Shop Shots from Atlas Press, a page on air power for assembly purposes, and another page about a carrier chain conveyor on a centerless grinder. Another single page tells how Curtiss-Wright drills a long shaft in a lathe—a story we spotted some time ago, but had to have cleared by the Air Forces before we could publish it.

Face Lift . . . You may have noticed some changes in page arrangement recently. With the July 10 issue, we moved three special news pages to the front of the book: Washington, Detroit, and New Tooling. We also initiated a special letter column called "Backlash," because we thought you'd be interested in extracts of some of our many letters, suggesting, amplifying, correcting, reminiscing, applauding—and occasionally abusing. Some other changes are in the making, all designed, as usual, to make your reading more convenient and interesting. We'd appreciate your comments on any or all of these changes, and your suggestions for further ones to increase your reading convenience.

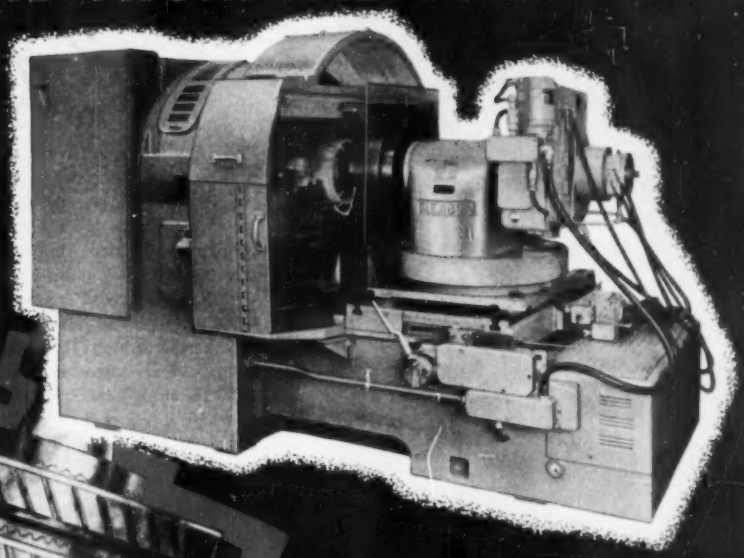
Test 'Em . . . Cadillac, like other companies, has long had the problem of the employee or the supplier with a new idea or method—and no adequate and disinterested testing setup. So Cadillac set up a special Trial & Test Group, consisting of specialist engineers who take such an idea to the machine or operation where it might be used and try it out. The suggestor can watch the tests, and if they show proper advantages, the idea or method goes in. That way everybody is satisfied . . . What's more, the Group checks back periodically, to see that all still goes well. The details, written by the Group Supervisor, are in our lead article—an idea that any company can use.

Welding a Die . . . Frank Macho, welding supervisor at Harnischfeger Corp., has summarized for us his methods of rebuilding forging-die sections. If done correctly, repaired dies often outlast the original ones.

Coming . . . Aug. 21 *AM* is chock full of short articles, on organized replacement, compound dies, a hydraulic duplicator, a parts conveyor, and forming electron-tube parts. There are three articles on fixtures: one on indexing automatically, one for spot welding, and one on locating parts for eyelet assembly. There'll also be both Shop Shots and Talented Tooling and another instalment of Martellotti. The Special Report is on Carbon Restoration in Steel—important to heat-treaters and process engineers.

TOOL ENGINEER . . . $2.50 per week, with a 50-cent raise every six months, was the written apprentice indenture for Albert P. Ohr when he started his toolmaking at J. K. Osborne Mfg. Co., Harrison, N. J. That was a 59-hour week, too. He worked as a toolmaker at N. J. Aluminum Co., and Sloan & Chase, in the latter case 5 years. Then he made machines for tabulating the 1910 Census at the company which became Powers Accounting Machine (now a part of Remington-Rand), doing experimental work, then calculator assembly, then service and maintenance. After four years, a reorganization put him out for 1½ years, but he came back as general foreman in charge of assembly. When Powers moved in 1922, he went into business for himself until 1935, when he came to Monroe Calculating Machine as tool engineer—really liaison between tool design and plant. He has been there since and developed the burring machine he describes in this issue.

INTERCHANGEABLE COUPLINGS GROUND FROM THE SOLID



• The Gleason No. 19 Curvic Coupling Grinder produces ground Curvic and Zerol face couplings automatically with a uniformity of machining which makes each part interchangeable. Replacement costs of large units can be materially reduced by using built-up units employing the principle of the permanent couplings.

The Gleason No. 19 Curvic Coupling Grinder with its automatic cycle control insures precision operation while the automatic dressing operation provides larger grinding wheel and diamond life.

GLEASON *Works*
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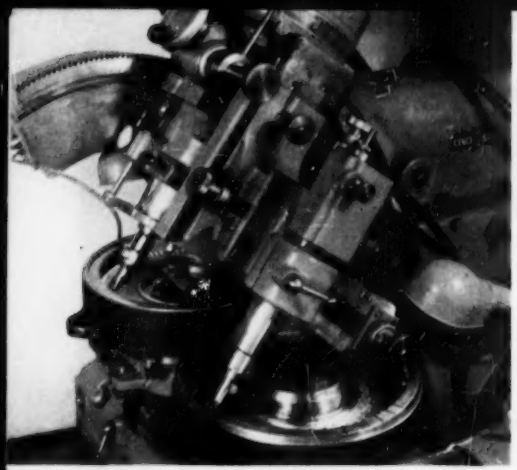
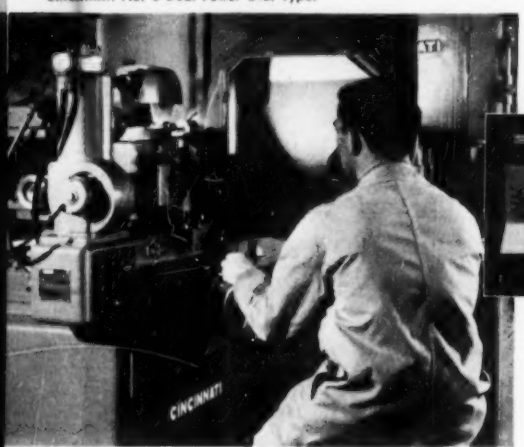
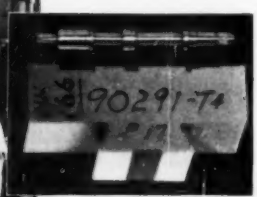


FINE DETAIL MILLED AUTOMATICALLY—Side pattern on slowly rotating master (foreground) automatically reproduced in tire mold by CINCINNATI 8" x 18" Tool and Die Miller. Hand finishing time greatly reduced.

DOWN-MILLING AND RAPID STOCK REMOVAL—Milling the top surface and slot (from the solid) of two cutter grinder tables at one time, removing 3/16" stock. Production nearly double with new CINCINNATI No. 5 Dual Power Dial Type.





UP TO FOUR TIMES FASTER—Grinding and inspecting simultaneously. Accurate form tool and die parts ground 30 to 400% faster on new CINCINNATI Projecto-Form Grinding Machine. Typical example inset.

NEW MACHINE . . . Hedge against

The immediate problem of all metalworking manufacturers, says a prominent publication in this field, should be to hold down manufacturing costs. What better way is there to do it than to discard old machines in favor of new ones wherever an appreciable cost saving can be made? If your plant is like thousands of others, you have on hand many old machine tools. How much will it cost you next year to keep these outdated machines running? You can get a general idea from the actual case histories cited here. All are CINCINNATI Milling and Grinding machines which have sharply reduced costs and created an excellent inflation hedge for their owners.

● A new CINCINNATI FILMATIC Micro-Centric Grinding Machine outproduces two old machines; cuts grinding costs 75%, and at the same time improves quality of sizing, roundness and squareness with one end. New machine investment is considerably less than previous equipment for comparable production.

● Five diameters of a food mixer shaft motor are ground at the same time on a CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped with an automatic hydraulic infeed attachment and automatic magazine feed. Compared to the previous method of grinding these shafts on a centertype machine, the cost has been reduced from five cents to one cent per shaft, saving about $9000 per machine in six months' time.

● A new Tracer Controlled CINCINNATI Hydromatic Milling Machine, tooled up to mill various sizes of turbine blades, reduced the time per blade from 480 minutes to 25 minutes.

CINCIN

MILLING MACHINES • BROACHING MACHINES •
FLAME HARDENING MACHINES
CUTTING FLUID • CENTERTYPE GRINDING
CENTERLESS GRINDING MACHINES

TOOLS *inflation*

CINCINNATI FILMATIC

● Glass molds, machined complete on a CINCINNATI 8" x 18" Tool and Die Miller, now require only a fraction of the hand finishing formerly required. Additional savings are realized in the copy milling operation; now 18 hours compared to the former method which required 28 hours.

● A progressive manufacturer of motors broaches the feet of motor frames on a CINCINNATI No. 5-54 Single Ram Vertical Hydro-Broach. One fixture accommodates four sizes of frames; cost reduced 40% over previous method.

● Small sizes of CINCINNATI knee-type milling machines —Nos. 2ML and 2MI—are capable of taking up to 25% heavier cuts than their predecessors; handling and set-up time is 15 to 25% faster. In the largest sizes—Nos. 5 and 6 Dual Power Dial Type—cutting capacity has been increased 50 to 75%; handling and set-up time cut 35 to 40%.

Case histories like those cited here are commonplace for machine tools bearing the Cincinnati trade-mark. A few more are illustrated at the left and right.

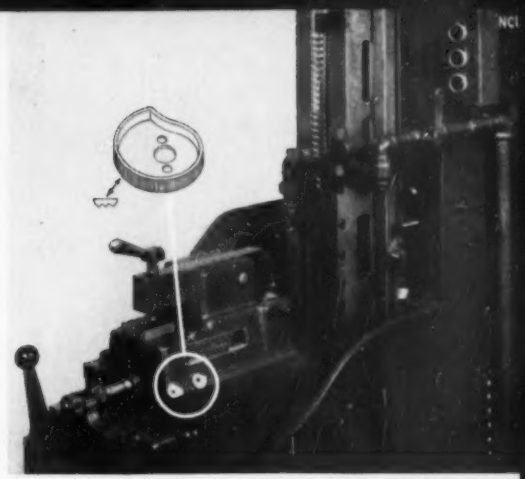
In all, there are 34 standard design types of Cincinnati Milling, Grinding and related machine tools, built in over 300 sizes and styles. CINCINNATI *FILMATIC Grinders handle work ranging from .004" diameter up to solid steel rolls 60" diameter, 15,000 times as large, and 665 million times as heavy. Cincinnati Milling Machines mill parts ranging in size from ¼" to 47' long. There's a Cincinnati for your type of work in the fields of: MILLING • BROACHING • CUTTER SHARPENING • DIE SINKING • GRINDING • CENTERLESS LAPPING. Write for a copy of our general catalog, No. M-1646.*

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

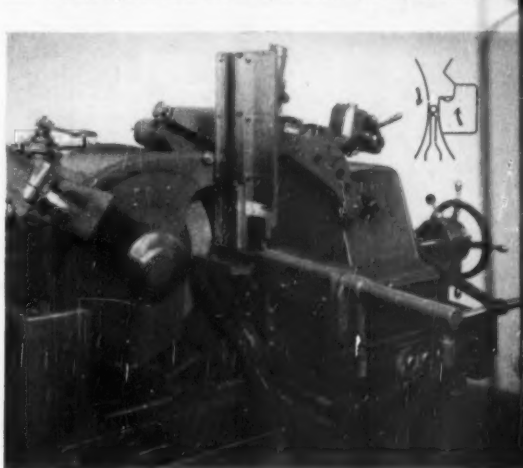
NATI

CUTTER SHARPENING MACHINES
OPTICAL PROJECTION PROFILE GRINDERS
MACHINES • CENTERLESS LAPPING MACHINES
MICRO-CENTRIC GRINDING MACHINES

REPLACE WITH A *NEW* CINCINNATI



540 PER HOUR—Sharply pointed, accurately spaced teeth broached in 540 business machine cams each hour by CINCINNATI No. 1-30 Single Ram Vertical Hydro-Broach. Pre-set cycle control protects operator.



NEW METHOD OF CENTERLESS GRINDING—Cammed regulating wheel takes over the function of feeding to size for the operation of infeed grinding twist drills on a new CINCINNATI FILMATIC No. 2 Centerless Grinder.

MAINTENANCE CHARGES DECLINE SHARPLY—This new CINCINNATI FILMATIC 24" x 96" Roll Grinding Machine will require little maintenance in the years to come. Filmatic bearings, automatic way lubrication and electronic table traverse control assure dependability.

GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

PLASTICS MOLDING MACHINES

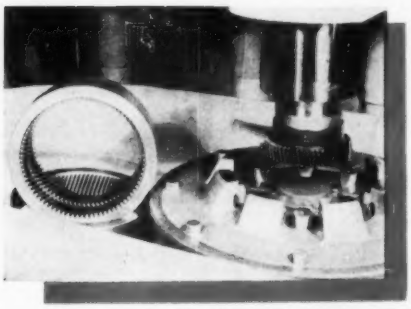
MAKING THE MOST OF MAN-EASE OPERATION, too

Fellows "Ten Station" Design Includes Quick-Acting Fixtures That Really "Give the Operator a Break"

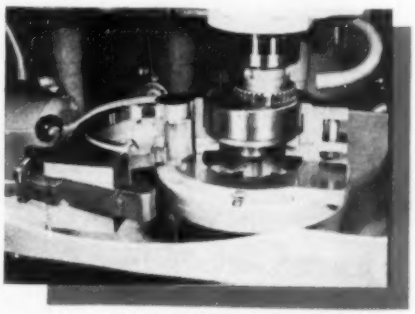
Operating the Rotary Gear Shaper is relatively simple. The machine, itself, has "time-cycle" controls which function automatically. Loading and unloading of work is easy . . . without haste or fatigue strain.

Quick clamping fixtures reduce the seconds of actual man-effort to a fraction of the available unloading-loading time. The multiple unit design of the machine permits the use of many types of fully or semi-automatic work holding devices.

The Fellows Rotary Gear Shaper is truly engineered for mass production of accurate gears. Let us study your gear problems with a view to increased production at lower cost. Contact the Fellows office nearest you.



As an example, this unique diaphragm-type chuck activates the clamping and releasing of the gear blank . . . timed to turret rotation of the machine.

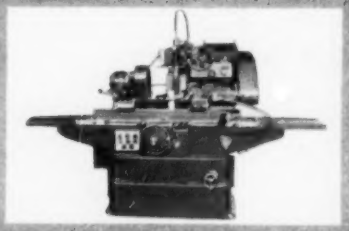


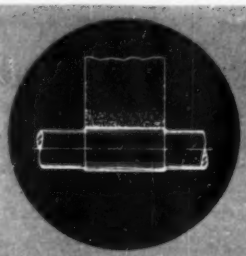
Hinged-type work holding outfit, an advantage in cutting long-shank gears.

Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont
Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 2206 Empire State Bldg., New York 1

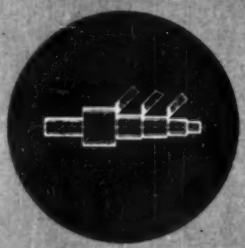
VAN NORMAN





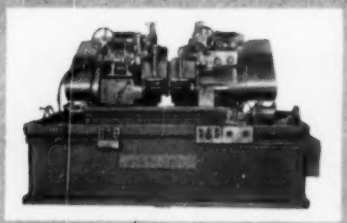
PLAIN CYLINDRICAL AUTOMATIC PLUNGE CUT PRECISION GRINDER

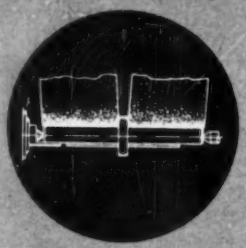
Bowgage Wheelhead feed assures extreme accuracy of control. Full automatic cycle leaves machine operator free to operate a second machine.



ANGULAR WHEELHEAD GRINDER

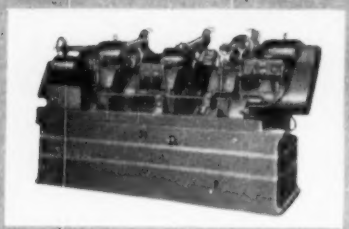
In this application, the operational set-up is at a 45° angle. Three spaced wheels are simultaneously grinding three shoulders. The complete grinding cycle is automatic — started by one push-button — self-stopping when correct size is reached.

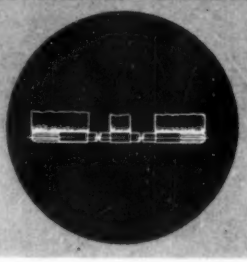




DOUBLE-HEAD GRINDER

Two 9½" face-grinding wheels plunge-cut the diameter, after which both wheels travel toward each other to grind the shoulder of the shaft — all in one set-up.





TRIPLE-HEAD GRINDER

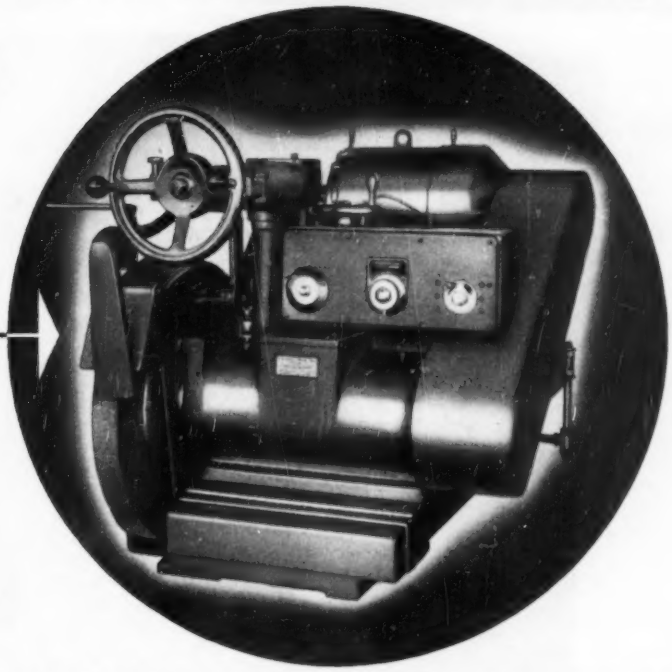
Three Bowgage Wheelheads assembled on a specially designed machine for multiple grinding. Three dimensions are automatically precision ground — at the same time.

"It pays to Van Normanize"

GRINDERS...

Increase Production...Save Money on Cylindrical Grinding

This Bowgage Wheelhead Unit is the Solution to Mass Production Grinding



You simply cannot beat the Van Norman Production Grinders for lowest-cost-per-piece automatic mass production grinding.

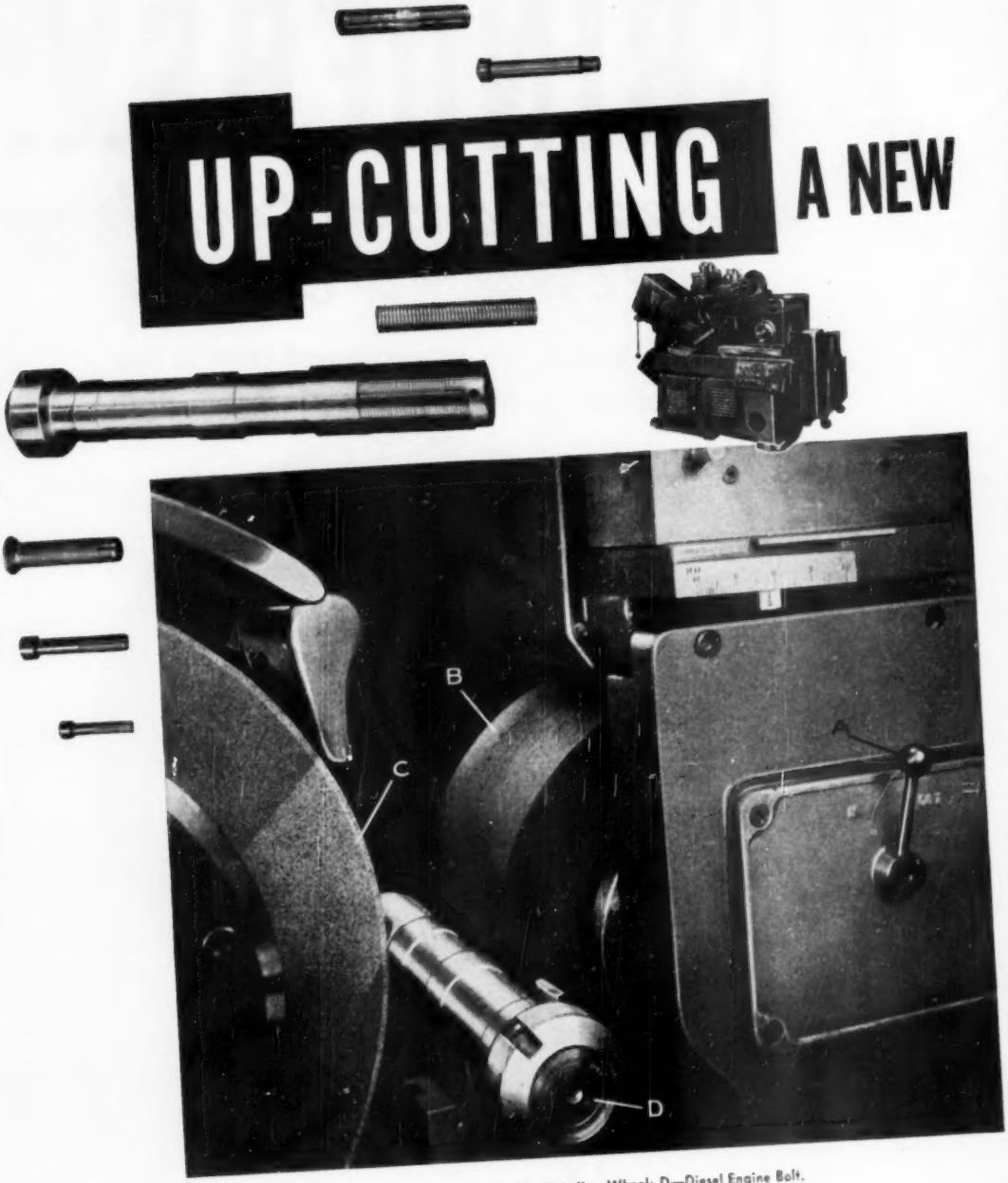
By taking one or more *Bowgage Wheelheads,* illustrated above, and mounting them on a suitable base, there is practically no limit on the number of diameters, tapers, shoulders, etc., that may be ground to close tolerances . . . automatically. See typical applications at left.

These completely automatic integral grinding units with gauging, rough and finish feeds, and automatic cycling with rapid traverse increase production, save time, cut costs. All the operator need do is load the work piece, push start button and the machine takes over performing all the operations and then stopping automatically for removal and reloading of the work.

Whether it's a standard or special purpose machine, it will pay you to *investigate* Van Norman Production Cylindrical Grinders. Write for information.

VAN NORMAN COMPANY
SPRINGFIELD 7, MASSACHUSETTS, U.S.A.

UP-CUTTING A NEW



A—Infeed Control Lever; B—Regulating Wheel; C—Grinding Wheel; D—Diesel Engine Bolt.

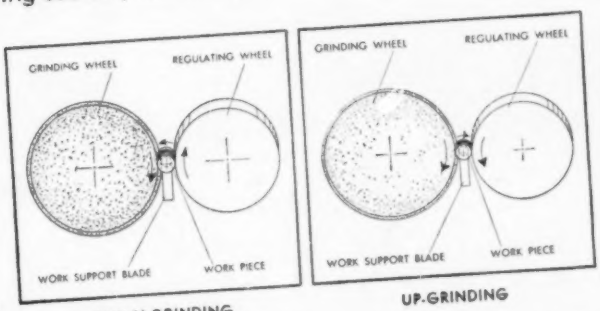
LANDIS *Machine* COMPANY

WORLD'S LARGEST EXCLUSIVE MANUFACTURERS OF THREAD

Centerless Thread Grinding TECHNIQUE

GREATER WORK SURFACE SPEED — BETTER THREAD FINISH

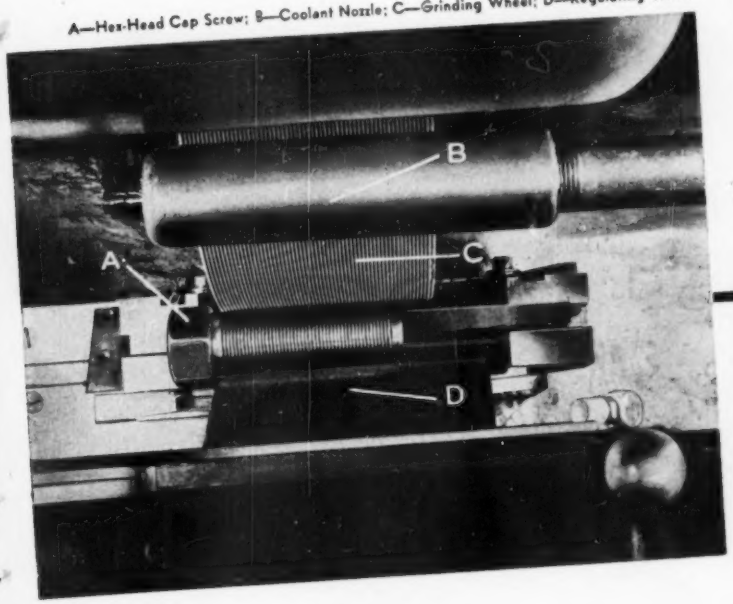
• Engineering research in our laboratories has developed a revolutionary new technique in centerless thread grinding—"up-cutting." The difference between "up-cutting" and "down-cutting," the method generally used for centerless cylindrical grinding and centerless thread grinding, is illustrated diagrammatically below. The new technique is generally to be used for infeed grinding and for large workpieces requiring coarse-pitch threads.



In "down-cutting," the surfaces of the workpiece and grinding wheel move in the same direction at the point of contact. In "up-cutting," the surfaces of the workpiece and grinding wheel move in opposite directions at the point of contact. Stresses imposed are reduced and work surface speeds can be used up to 30% greater than for similar "down-cutting" conditions, with fewer wheel dressings. All forces act downward, holding the workpiece firmly on the workrest blade and reducing chattered finishes under heavy cuts. The regulating wheel solely controls work rotation and the end-wise travel in timed relation to its rotation, completely independent of friction between the grinding wheel and the workpiece. Spinning of the work is practically eliminated, especially when grinding coarse threads on heavy workpieces.

Write for Bulletin E-97

A—Hex-Head Cap Screw; B—Coolant Nozzle; C—Grinding Wheel; D—Regulating Wheel.



WAYNESBORO PENNA. U. S. A.

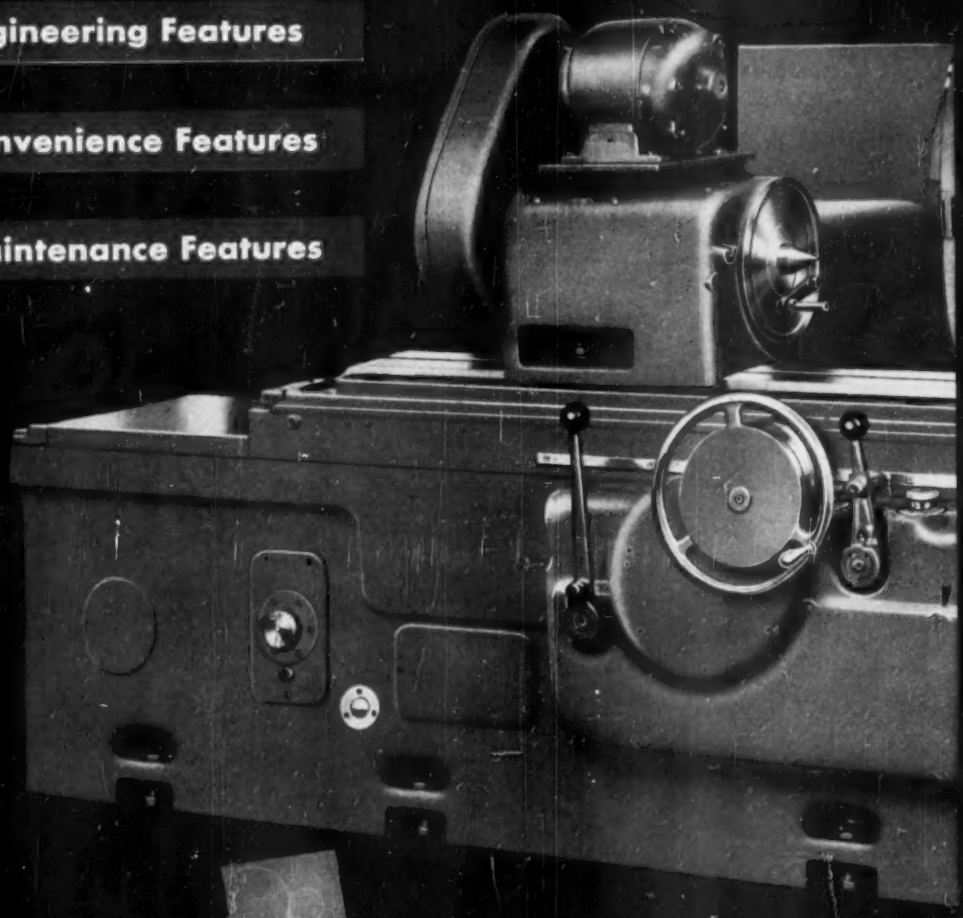
GENERATING EQUIPMENT

NEW LANDIS TOOL

NEW Engineering Features

NEW Convenience Features

NEW Maintenance Features



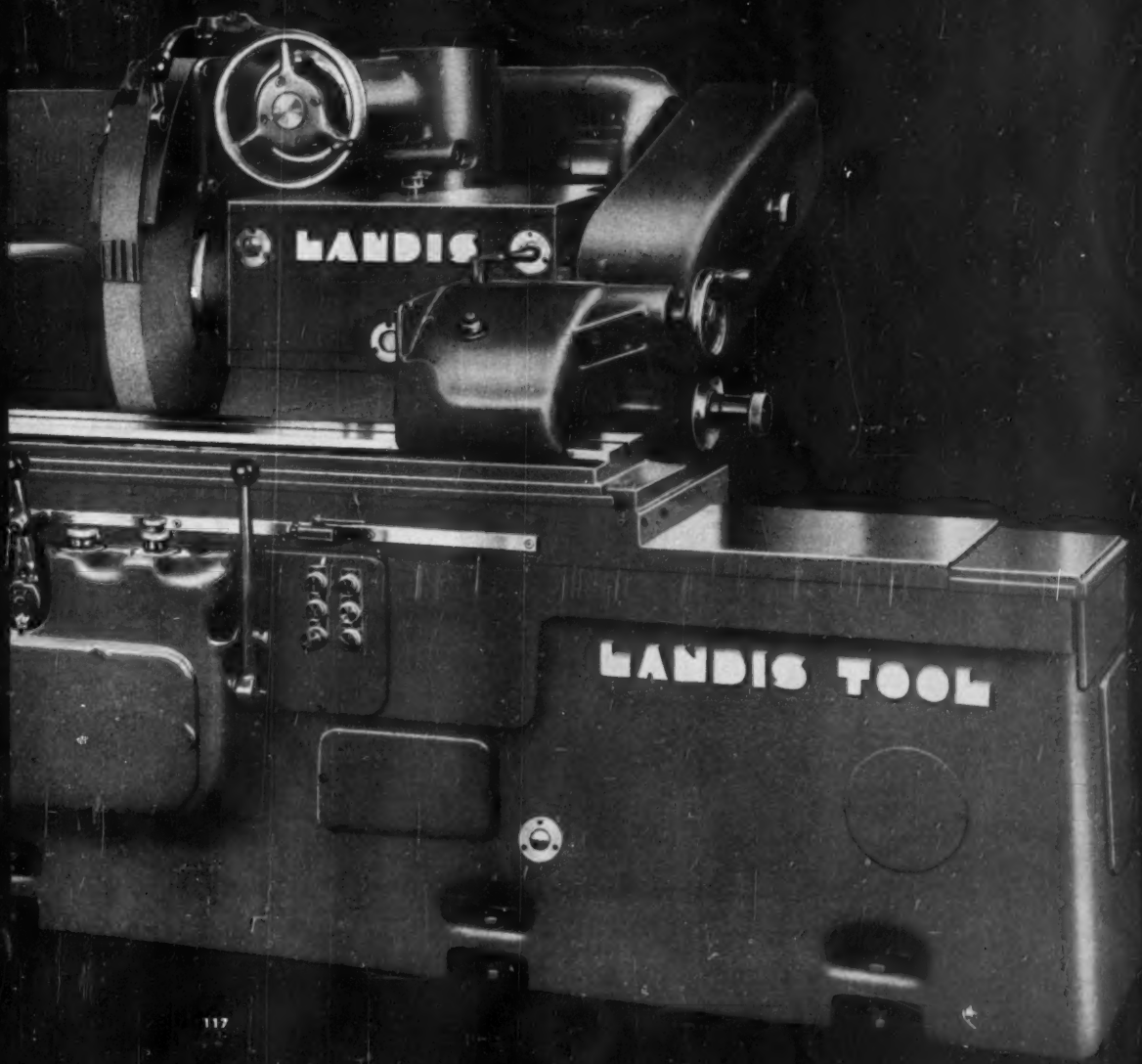
Request Catalog B-50 for detailed specifications.

LANDIS TOOL
Precision Grinders

Machine illustrated is a Landis Tool 14" x 48" Type CH Plain Hydraulic Grinder.

Plain Hydraulic Grinder

10"-14" Type CH

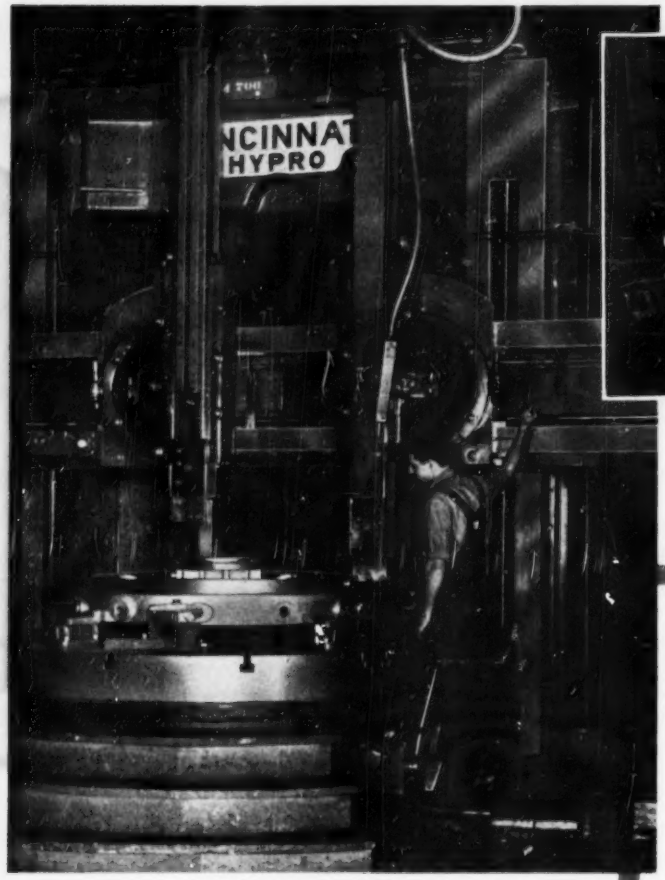


117

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

Cincinnati Vertical Boring

MAINTAINS BORE AND SURFACE



Two heads operate simultaneously to speed overall production time on this radial engine cover casting.

Close up view of cover under side. Multiple operations must be accurately completed to insure proper crankcase fits.

The way this job is handled...

First Setup

1. Rough counterbore 32" diam. 1/2" deep.
2. Rough Face casting top.
3. Rough out 9" diam. bore.
4. Bore light locating cut in bore.
5. Finish counterbore.
6. Finish top face.
7. Finish 32" diam. counterbore face.
8. Cut 3/8" diam. x 3/16" oil groove on top face.

MACHINE: 8' Cincinnati Vertical Boring and Turning Mill

TIME: Overall approximately 18 hours

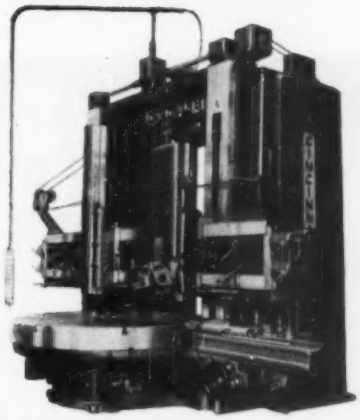
✦ PHOTOGRAPHS COURTESY NORDBERG MFG. CO. MILWAUKEE WIS

HYPRO

THE CINCINNATI

Subsidiary of Giddings & Lewis Machine

and Turning Mill RELATIONSHIPS *within .001"*



This standard Cincinnati HYPRO Vertical Boring and Turning Mill with two rail heads, and side head offers unusual machine possibilities on a broad range of work.

2 Rail Heads Operating Individually and Simultaneously Complete 16 Cutting Operations in 2 Setups on 58½" Diameter Radial Diesel Engine Crank Case Cover Casting

Second Setup

1. True to operation 4 first setup.
2. Rough turn 4 faces for crankcase fit.
3. Rough turns on 18-1/2" diam. inner flange and 54" outer flange.
4. Rough inner face for gear clearance.
5. Loosen workpiece and recheck to bore locating mark.
6. Follow above operations finishing to .001".
7. Finish 9" bore to .001".
8. Recess groove in 9" bore for oil.

CUTTERS: Kennametal
MATERIAL: Cast iron
SPEED: 25 R.P.M.

Holding accurate dimensional relationships on the job between bore center and flange face, as well as other machined casting surfaces becomes a simple matter when a Cincinnati HYPRO Vertical Boring and Turning Mill is used.

For example, sides of the 58½" diameter cover casting are machined in two settings. The first setup operations include in part: facing to insure proper casting clean up; rough boring, counterboring and grooving. In the second setup, turning, facing, and finish boring operations are completed. Independent feed and traverse is furnished to each head, which speeds overall machining time. In addition to reducing cutting time, use of the Cincinnati HYPRO solid narrow guide cross rail insures greater accuracy.

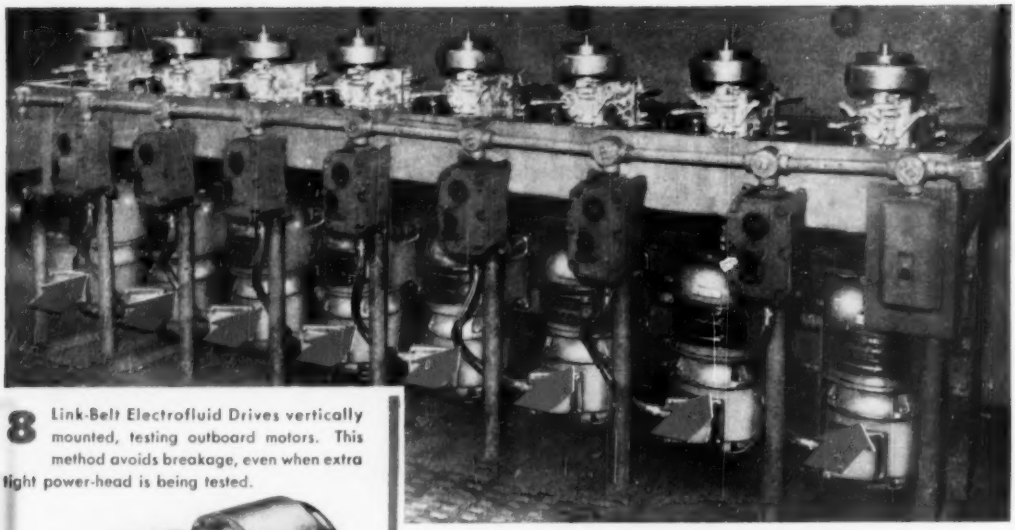
Relationship between the bore center and the flange periphery is easy to maintain, since the table is mounted on high precision roller bearings. Full machine control enables the operator to work either head on the rail to predetermined settings. This in turn reflects in the finished accuracy of the workpiece. All dimensions are readily held to .001" to meet inspection and crankcase assembly requirements.

Multiple Machining Operations For Important Component Fits

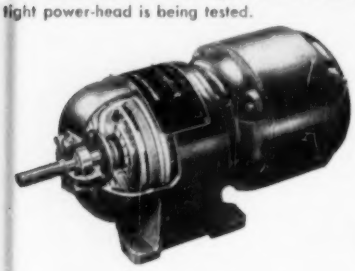
Boring, turning, chamfering, facing, counterboring, grooving, recessing are a few of the many machining operations economically performed on the Cincinnati HYPRO Vertical Boring and Turning Mill. Built-in machine accuracy combined with ease of control and greater flexibility makes it possible to machine a broad range of equipment components and parts. When this machine is used you are assured of precision fits in subsequent assembly operations. If you are now faced with troublesome machining jobs on large or unusual parts, our engineers will gladly consult with you and point out the advantages of using this vertical mill for your needs.

PLANER COMPANY

Tool Company, FOND DU LAC, WISCONSIN, U.S.A.



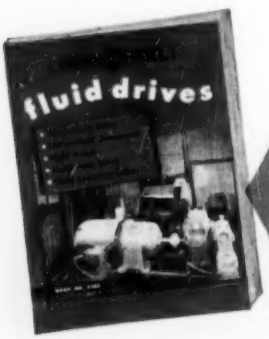
8 Link-Belt Electrofluid Drives vertically mounted, testing outboard motors. This method avoids breakage, even when extra light power-head is being tested.



LINK-BELT FLUID DRIVES

MADE IN 5 TYPES

The Electrofluid Drive is one of five different types in which Link-Belt Fluid Drives are available. Book No. 2385 describes and suggests applications for the Electrofluid Drive, the Electrofluid Gearmotor, the Fluid Drive, the Fluid Gear Drive and the Fluid Coupling Drive. You'll find this information valuable. Send for your copy NOW.



Send now for Book 2385, with full details and application data.

- SMOOTH OUT SHOCK LOADS
- PROTECT MOTORS AND DRIVEN MACHINERY
- REDUCE POWER CONSUMPTION
- ELIMINATE BREAKDOWNS

Heavy duty machine tools, long conveyors and similar load applications present the severe drive conditions Link-Belt Fluid Drives were developed to meet. Cushioning effect of the drive permits the motor to gain speed smoothly, rapidly, under low torque, keeping starting current at a minimum and permitting the use of a smaller motor than would be feasible otherwise. Gears, chains, belts and speed reducers in the driven mechanism are protected against strain or impact. Overloads will not stall motor, but will slow it down until protective relay trips; the Fluid Drive will resume operation when jam or overload is cleared.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices, Factory Branch Stores and Distributors in Principal Cities. 51.1903

LINK-BELT

fluid drives

This can be the Most Profitable Prospecting in the World!

Explore Your Product for "COUNT-Ability"

WHEN IT "PANS OUT" that a product can be taught to count to the greater benefit of its users . . . then, by the same token, it will count to the greater profit of its maker.

Witness the case of the manufacturer of electrical equipment who . . . in a hotly competitive market . . . built a Veeder-Root Counter into his product to record the number of times that product was push-buttoned into service by its users. *And so he proved his service guarantee beyond argument or doubt* . . . while his competitors were still hurling words instead of Facts-in-Figures.

Now . . . what about looking for new pay-dirt in *your* product?

Small Reset Counter, built into many products to count strokes or turns. For picture of complete line of mechanical and electrical counters, write for *free* 8-page "Count Book" below.

Veeder-Root **COUNTERS**

VEEDER-ROOT INC., HARTFORD 2, CONN.
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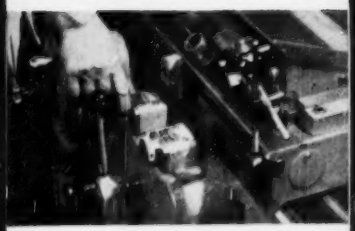
In Great Britain: Veeder-Root Ltd., Kilspindie Road, Dundee, Scotland.

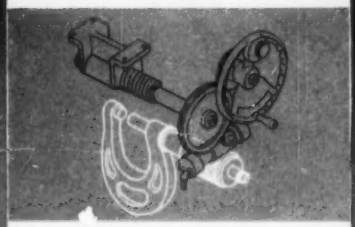
To Buy the Best . .

OPERATORS SAY—

"Easier to handle"



"Like a push-button radio"

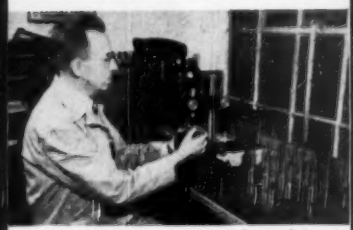


"Really holds size"

"Eliminates worry of work spoilage"

MANAGEMENT SAYS—

"Outperforms earlier makes"



"Inspection costs reduced by uniform sizing performance"

Four new free catalogs describe the features of the CTU machines. No. 1787 covers the 10" semiautomatic, No. 1488 the 6" semiautomatic, No. 166 the 10" plain and No. 157 the 6" plain machine.

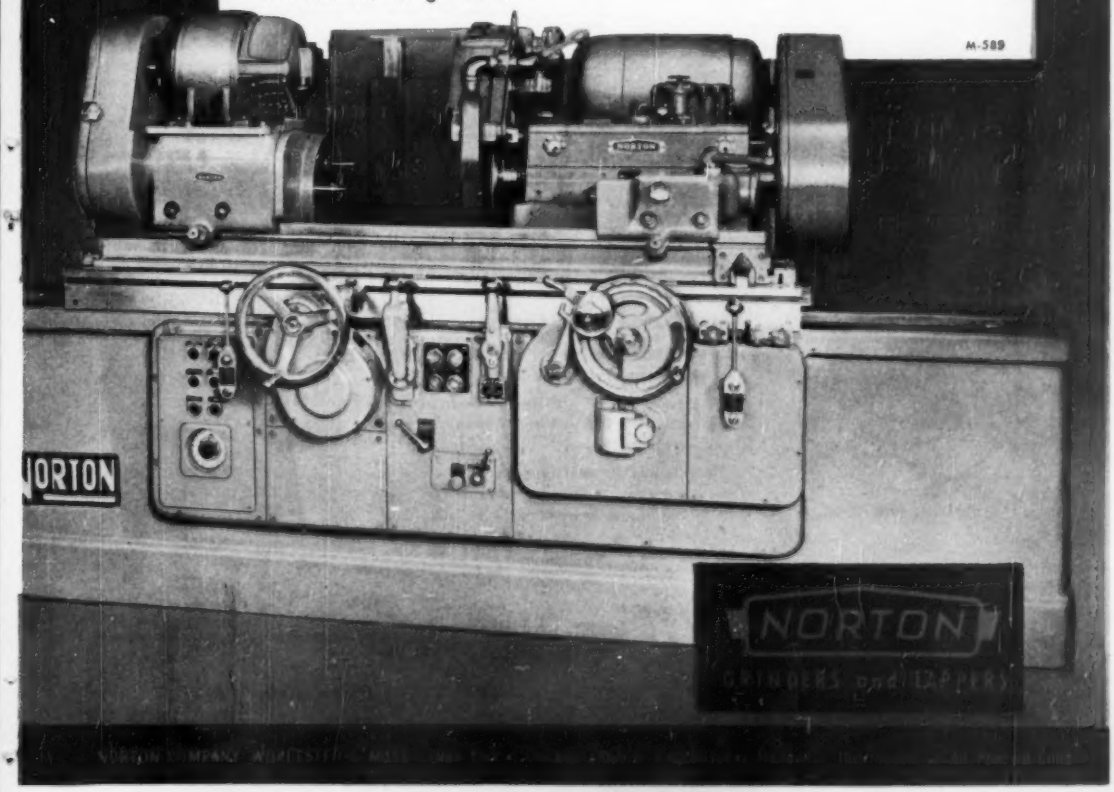
Making better products to make other products better

. . in Cylindrical Grinders

Ask the Men Who Know the Norton TYPE CTU Machines

MANAGEMENT men and operators combine to put their stamp of approval upon the Norton Type CTU machines for these important reasons. Outstanding are the high productive capacity, superior quality of work, minimum floor space and reduced maintenance obtained with the 6″ and 10″ Norton Type CTU cylindrical grinders. Older or less productive grinders cannot successfully compete in these times of rising material and manufacturing costs. Use of more productive equipment is the only way costs can be substantially reduced. That is why it does not pay to keep obsolete models in production and ignore the cost savings and other important advantages that may be obtained from the strictly modern and more efficient Norton grinders.

M-589

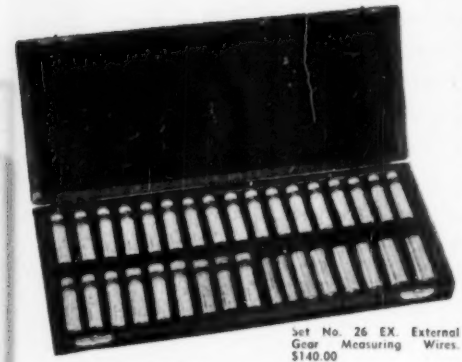


ACCURACY the EASY WAY...

with the

Van Keuren >>>> GEAR MEASURING SYSTEM

Spurs, Helicals, Splines, Serrations



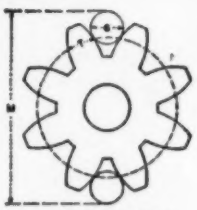
Set No. 26 EX. External Gear Measuring Wires. $140.00

THE Van Keuren Gear Measuring System is generally accepted as the easiest and most accurate method of checking tooth thickness of gears, 30° involute splines and 90° involute serrations. A measurement is made over two opposing wires and this actual measurement is compared with the theoretical measurement over wires for a perfect gear as computed from the Van Keuren tables for 1 diametral pitch gears.

The only equipment required is a set of 2 wires of the proper size for each diametral pitch.

Standard sizes of wires available from stock are:—

1.728" / DP	for external spurs and helicals.
1.44" / DP	for internal spurs and splines.
1.92" / DP	for enlarged pinions, 30° involute splines and 90° involute serrations.
1.68" / DP	Alternate series for special requirements.



EXTERNAL SPUR GEAR

SIMPLE . . .

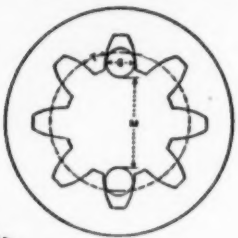
For spur gears, involute splines and serrations, the only calculation is one of simple division. For helical gears use the simplified computation forms VK-103, VK-104 or VK-105.

RELIABLE . . .

The 1.728"/DP System is used by over 90% of American gear producers and users. The 1.44"/DP and 1.92"/DP systems have been incorporated in standards for involute splines and serrations.

ACCURATE . . .

The Van Keuren Gear Tables are complete for gears from 5 to 500 teeth and for pressure angles of 14½°, 17½°, 20°, 25° and 30°. If the measurement over the wires is greater than the value calculated from the tables, the tooth is too thick and the cutter must be fed further into the gear blank. Constants for controlling tooth thickness and backlash to .0001" are given for all pressure angles.



INTERNAL SPUR GEAR

MEMBER OF AGMA

CATALOG AND HANDBOOK No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies now free upon request.

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

31st YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

Adds Years of SERVICE...

Yes, the patented double low-hung spindle drive adds years of effective service to "AMERICAN" Hole Wizard Radial Drills—and in addition insures smooth holes and more holes per drill grind

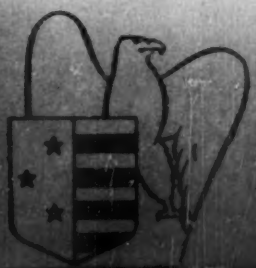
This patented spindle construction provides two drives—one through a large helical gear for the low-speed range and one through a smaller gear for the high-speed range. This division of service between one large diameter and one smaller diameter gear results in low gear tooth pressures when performing large diameter drilling and boring operations through the low-speed range and low gear velocities when drilling at high speeds through the high-speed range. This is an ideal drive and unmistakably adds up to a longer and more effective life for the spindle transmission.

However, this is only part of the story. This drive is located at the bottom of the head as close as possible to the work, definitely reducing the torsional stress on the spindle, thus imparting a smooth action to it which in turn results in smooth, high quality work and prolongs the cutting edges of the tool.

The spindle itself is made of NITRALLOY steel as is also the spindle sleeve and both are nitrided for extreme surface hardness, the spindle being ground and the sleeve honed to very close limits. The spindle and sleeve are Timken mounted with an adjustment for wear. This construction, combined with thorough lubrication by filtered oil, insures long life, maintained accuracy and low maintenance.

Cost-minded officials select "AMERICAN" Radials

Will gladly send literature



THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

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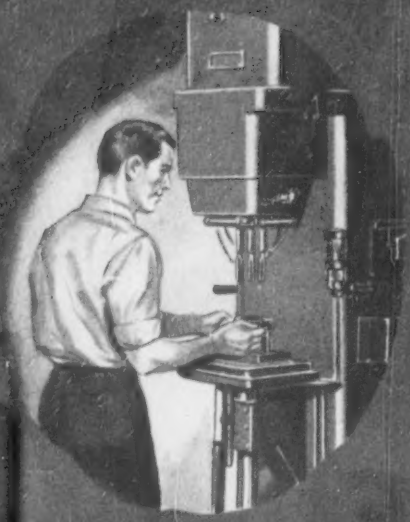
WINTER

CHIP DRIVER TAPS



One of the important problems on many high speed production tapping jobs is to get rid of the chips without choking the tap or scratching the completed thread.

Winter Balanced Action Chip Driver Taps (Spiral Point) do this successfully. The accurately ground and scientifically designed chip driver contours drive the chips ahead of the tap, so that no chip choking can occur. These taps are suitable for a wide variety of tapping operations, *but are not recommended for use in blind holes.*

Other Winter products include Precision Commercial and Cut Thread Taps of all common types, such as Four Flute, Three Flute, Machine Screw and Pipe Taps and many others.

ALWAYS AT YOUR SERVICE—YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.

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THE WIDE APPLICATION NATIONAL END MILLS

A wide variety of milling operations that cannot be done by any other tool can be advantageously performed by end mills.
National End Mills are available in a great many types and sizes to meet these varied job requirements.
Shell End Mills, Heavy Duty Taper Shank End Mills, Helex End Mills in Single and Double End construction, small diameter Short Series End Mills and many others are available from stock.
National Engineers will recommend the best type for your application.
The complete National line also includes Twist Drills, Reamers, Counterbores, Milling Cutters, Hobs, and Special Tools.

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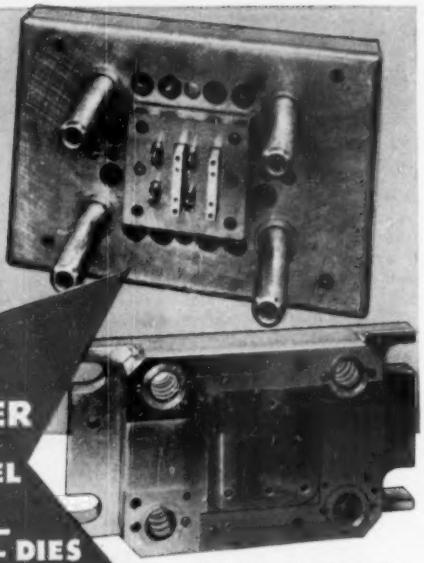
Surface grinding a punch without removing guide pins.

STAR PERFORMER

ON HIGH SPEED STEEL AND *CARBIDE* DIES



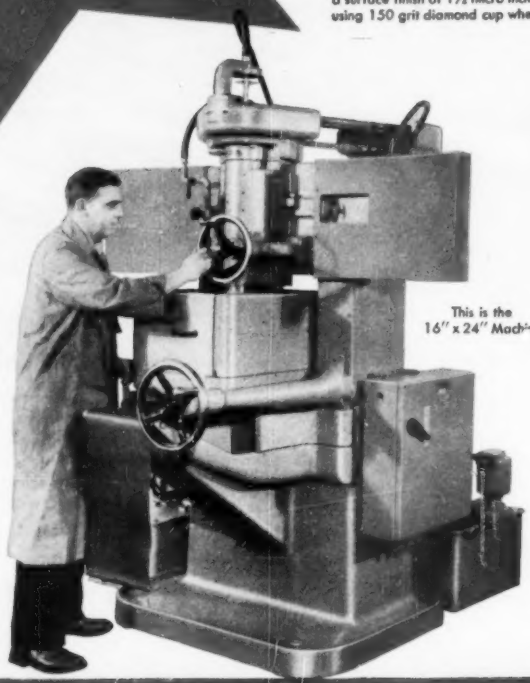
Carbide die and punch ground to a surface finish of 1½ micro inches, using 150 grit diamond cup wheel.

THE ENTIRELY *NEW* PRATT & WHITNEY DIE AND SURFACE GRINDER

16" x 24" *and* 36" x 42"

Brings new conveniences, new speeds, new economies in the surface grinding of dies and tools of *CARBIDE* or tough die steels. Specifically designed for facing new die blocks, reconditioning dulled impression edges and preparing worn dies for resinking. Operating like a profiler, it readily finishes flats around irregular reliefs . . . and is ideal for precision step grinding. Produces finishes to micro inch smoothness without need for subsequent lapping or polishing, and with minimum breaking-down of cutting edges, thus increasing productive life of die set between grinds.

Smooth hydraulic table drive gives exactly the right speed for the job up to 20 f.p.m. . . . three spindle speeds permit the use of different diameter wheels . . . compact, vertical design conserves floor space. Write for the full details.



This is the 16" x 24" Machine.

PRATT & WHITNEY

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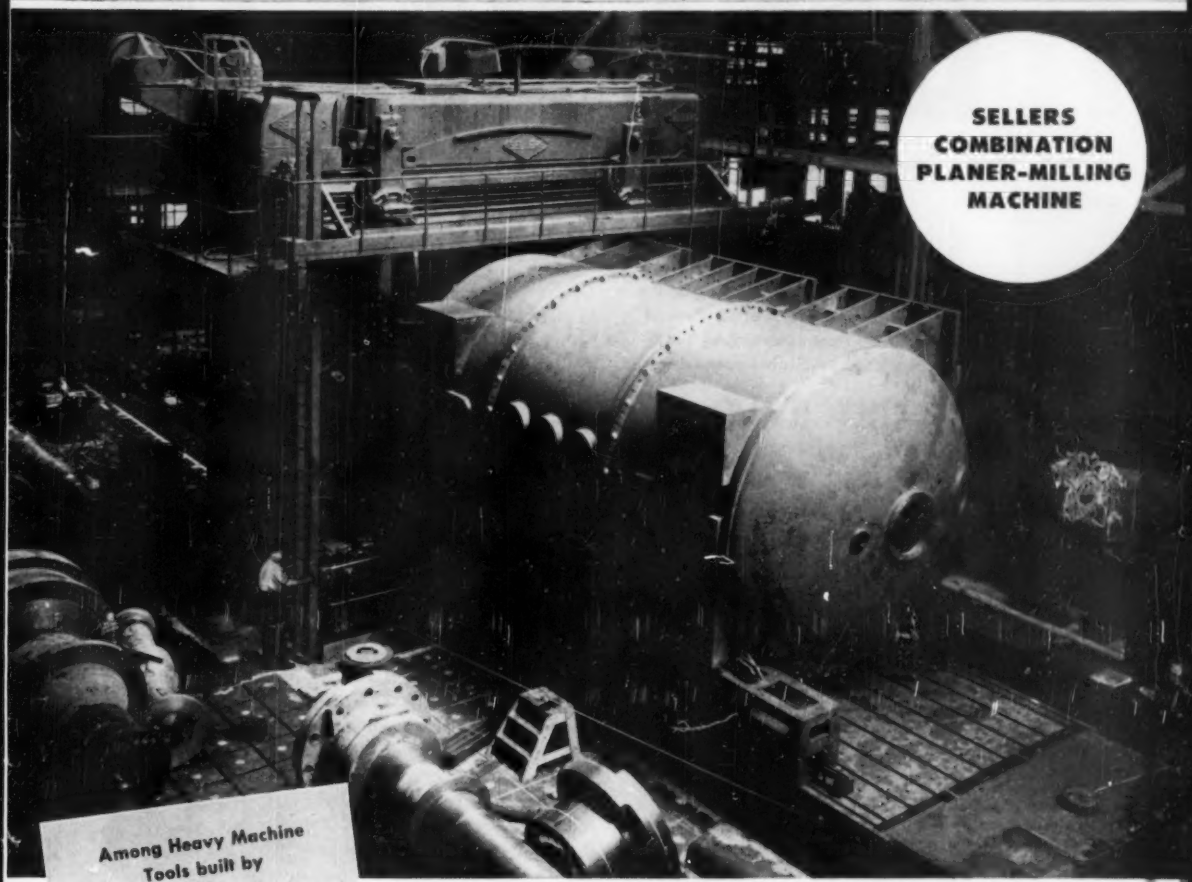
MACHINE TOOLS • CUTTING TOOLS • GAGES

90th Year

SYMBOL OF ACCURACY SINCE 1860

ANOTHER GIANT CONSOLIDATED SPECIAL MACHINE FOR UNUSUALLY LARGE WORK



Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
MILLING MACHINES
BORING MACHINES
COLD SAW MACHINES
BORING, DRILLING AND MILLING MACHINES
DRILL AND TOOL GRINDERS
PLANERS
SLOTTERS
RAILROAD SHOP TOOLS
AUTOMOTIVE TOOLS
AND OTHER SPECIAL MACHINES

SELLERS COMBINATION PLANER-MILLING MACHINE PLANING A HUGH CASING

The Sellers Combination Planer-Milling Machine is used in the production of equipment for industrial and power generating applications such as, synchronous condensors, hydraulic turbine-driven generators and large motors and generators for steel mills and similar installations. Two machines in one . . . a planer and a miller . . . it eliminates the necessity of transfering work from one machine to another when both planing and milling operations are required. This huge machine is over 76 feet long, 27 feet high and weighs more than 645,000 pounds. It has the capacity to machine work 14 feet wide, 16 feet high and 30 feet long. Due to the enormous capacity of the machine, several parts to be machined may be bolted together and handled as a single unit.

BUILDERS OF HEAVY DUTY MACHINE TOOLS SINCE 1848

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CONSOLIDATED MACHINE TOOLS

CONSOLIDATED
MACHINE TOOL CORPORATION

ROCHESTER 10, NEW YORK

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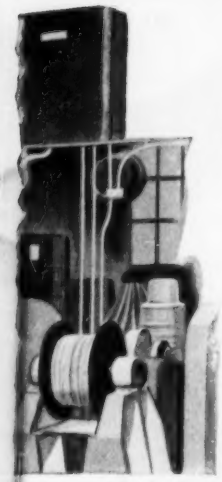
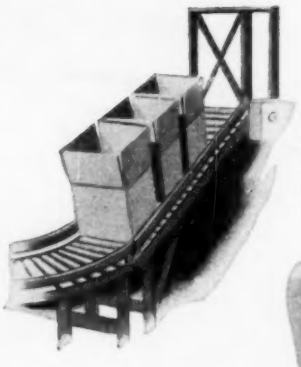


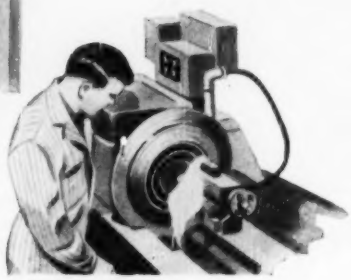
Boosted winding rate 300%

Here's a gain chalked up on the wire rewinders of a Pennsylvania steel company, by installing G-E adjustable-speed drives.



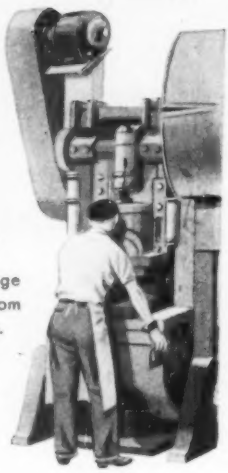
Speeded packaging 55%

Output of a box-sealing machine, newly equipped with adjustable-speed drive, jumped from 38,000 to 60,000 cartons per hour.



Stepped up punching 968%

A feat performed on a large punch press, hiking output from 78 to 800 parts per minute.

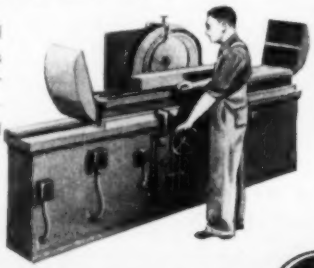


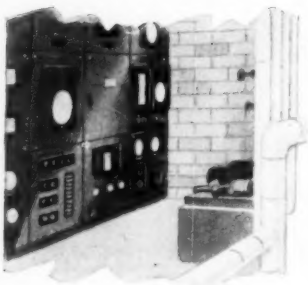
Raised turning output 66%

This was worked out by specifying adjustable-speed drive on an automatic lathe.

Increased grinding production 40%

This gain was achieved on a Buffalo company's face and knife grinder with—you guessed it—an adjustable-speed drive.





Speeded proportioning

A chemical manufacturer found it possible to go from batch to continuous processing in the production of phthalic anhydride by using adjustable-speed drives.

GENERAL ELECTRIC

751-1

BOOST OUTPUT

General Electric adjustable-speed drives can increase the output of your machines—make them more accurate, more versatile

Extra production you never expected may be ready to roll from your driven machines. Call it bonus production, since you get it by using improved speed control, and not by adding new machines. You can expect even more than boosted output from properly applied adjustable speed—it's a single-handed help in improving product quality, minimizing waste of time and materials, and cutting down on rejects.

Adjustable-speed drives have been around for years. But General Electric has brought them to a new high in versatility and power to work production miracles. Now you can buy G-E drives precision-engineered to your machines, at mass-production prices. Now you can choose from a complete line of General Electric Drives—packaged drives providing utmost flexibility. G-E drives offer plants that can use better speed control a quick way to halt the squeeze on profits.

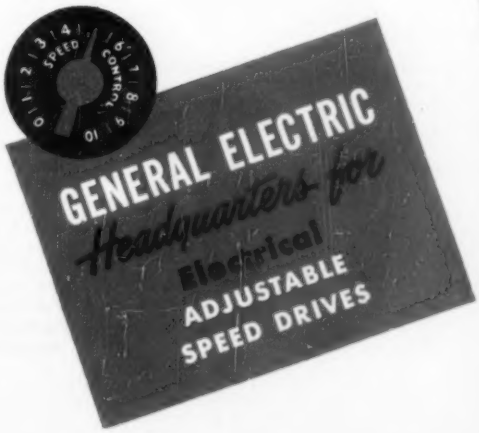
TO UNCOVER OPPORTUNITIES for saving through the application of adjustable speed in *your* plant, General Electric offers this help:

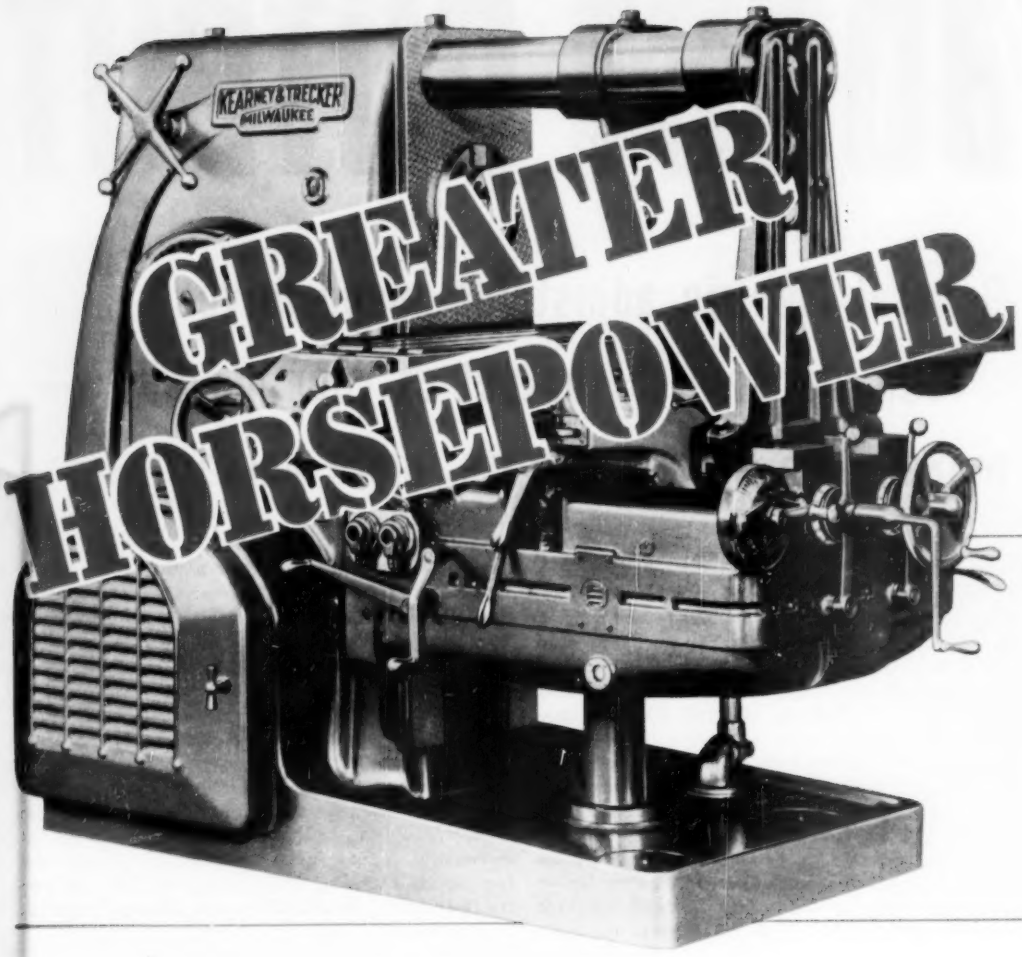
First, the assistance of specially trained sales engineers who bring you the benefits of experience gained in applying adjustable speed to practically every kind of machine in practically every industry. Pick up your phone now and call your nearest G-E field office. You'll find the telephone number listed in your directory.

Second, a comprehensive, carefully illustrated book on the *whole* subject of adjustable speed. It's written from management's viewpoint, but backed up with all the facts an engineer needs. Write for your copy. *Apparatus Department, Sec. 751-1, General Electric Company, Schenectady 5, N. Y.*

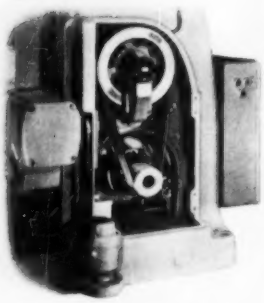
New G-E Booklet on Adjustable-speed Drives

Your copy of the new 24-page adjustable-speed booklet is ready. Please write for Bulletin GEA-5334 on your business letterhead.





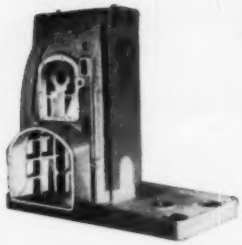
GREATER HORSEPOWER



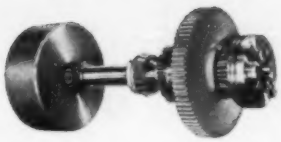
KEARNEY & TRECKER MILWAUKEE **CK's**

With the broader use of carbide and cast alloy tools for milling ferrous and non-ferrous materials, progressive shop men have demanded *greater horsepower* to take fullest advantage of these tools. Kearney & Trecker's new CK milling machines meet this demand. Depending on machine size, (No. 2, 3, 4, 5, or 6) you get 10 to 25 hp independent motor spindle drive plus separate 3 to 5 hp feed and rapid traverse drive. Spindle and feed motors are interlocked with positive automatic safety control for overload conditions. No danger of stalling cutters in cut. Added to *greater horsepower* are the many other pace-setting CK features — that give you the most productive, profitable milling machines you can buy today — anywhere!

Replacement of obsolete machine tools is an



GREATER RIGIDITY — Yes, these new CK columns are the most rigid milling machine columns we've ever designed! They give you 1000 pounds more metal scientifically distributed in heavier ribbing, box section, sponson construction . . . to effectively absorb vibration from heaviest cutting loads.

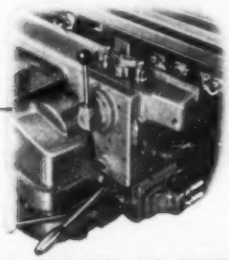


GREATER CUTTING EFFICIENCY — Added momentum of spindle-mounted flywheel assures longer cutter life and greater efficiency, through smoother, more positive drive — a key to most efficient use of modern cutting tools. Spindle rigidly supported by Kearney & Trecker's original 3-bearing design.

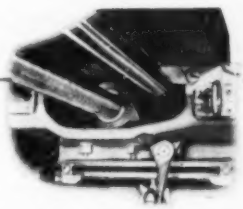
GREATER ADAPTABILITY — No. 60 Heavy Duty drive flange on Nos. 4, 5 and 6 machines enables use of heavy duty arbors with flange drive for large single or multiple cutter setups; or bolting large face-milling cutters directly to spindle nose. Average setups use standard arbors with No. 50 spindle drive.

NON-GLARE RAPID-SET DIALS—You'll avoid costly errors in reading and setting these new micrometer dials. They're vapor blasted to give you a satin surface with high contrast markings. They're easy and quick to set and provide positive lock at every setting.

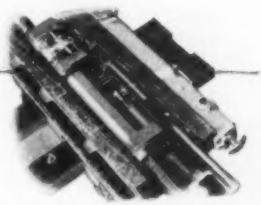
FEEDS AND SPEEDS TO TAKE FULL ADVANTAGE OF MODERN CUTTING TOOLS — and you really can do it with the broad feed and speed ranges on Kearney & Trecker's new CK milling machines. You get 24 spindle speeds (15 to 1500 rpm on Nos. 2 and 3, 13 to 1300 rpm on Nos. 4, 5 and 6) with Kearney & Trecker's automatic protecto-mesh shift to eliminate gear clashing. And there's the extra-wide feed range — 32 changes from $\frac{1}{16}$" to 90" per minute—with separate 3 or 5 hp feed and rapid traverse drive.



GREATER PRODUCTION AND GREATER OPERATING CONVENIENCE—Production men will like Mono-Lever Control because it reduces idle cutter time, shortens floor-to-floor cycle time on both long and short run lots. Operators will like it because it makes faster, simpler, less fatiguing work for them.



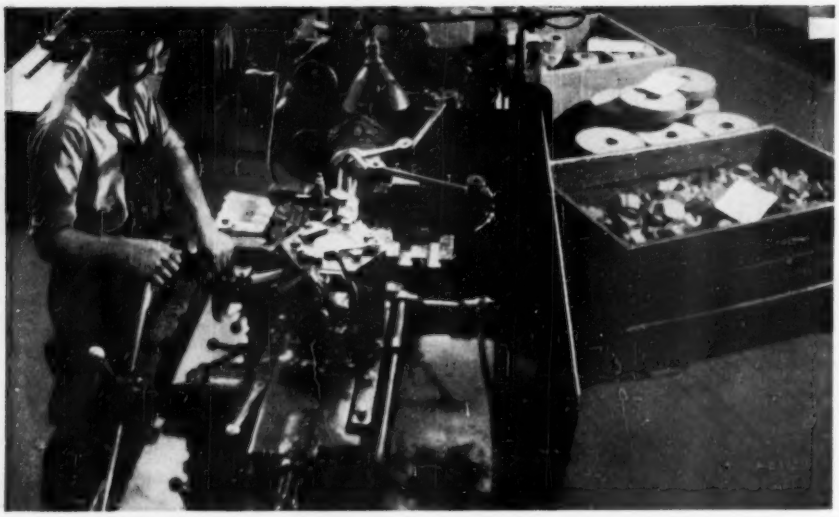
SMOOTHER FEED PERFORMANCE — with a new design 2" diam. heavy-duty, table feed screw that affords greater bearing contact and runs through an extra-long table feed nut. These new CK machines are equipped with a backlash eliminator for more effective climb milling, more accuracy and longer screw life.



GREATER MACHINE LIFE — through automatic lubrication and generously proportioned gears and shafts throughout for overload conditions. There's a forced flood system in the column and knee, and a positive metered, pressure pump system for table, saddle and knee ways, and table feed assembly.

Kearney & Trecker's new CK Line is designed to meet every demand of present-day milling operations . . . making CK machines more accurate, and MORE PRODUCTIVE for you. Contact your nearest Kearney & Trecker representative or write direct to obtain complete specifications of these fine new machines. See how they easily replace obsolete machines at substantial savings to you. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

investment that makes Dollars and Sense.



YOU MAKE THE SCREW MACHINE PARTS

Reynolds will supply the right aluminum

When you pick a screw machine stock you're looking for the right combination of characteristics. You can get it in one of the Reynolds Aluminum alloys—the modern *metal with muscles.*

In addition, with aluminum, you always enjoy the advantages of freedom from rust and the light weight that enables you to get three times the number of pieces per pound. Shipping costs are less too. And there's a wide variety of natural and anodized color finishes for consumer appeal or code indentification.

Listed under "Aluminum" in the 'phone book is a Reynolds distributor. Call him for prompt delivery service on Reynolds Aluminum screw machine stock—or for other aluminum products, ingot, sheet, wire, rod, bar, structurals, extrusions, pipe and tubing. Or write direct to Reynolds Metals Company, 2523 South Third Street, Louisville, Kentucky.

***It's FREE**—write on your company letterhead for a copy of "Machining Aluminum Alloys".*

SCREW MACHINE ALLOYS

R317-T4—Fine finishes at high speed. Free cutting, fine chips, good strength. Excellent for screw machine work.

11S-T3—Free machining. Longer tool life but slightly less strength than 17S-T4 and R317-T4. Good formability of machined parts.

17S-T4—Excellent finishes. Fine for general purpose machining. Good corrosion resistance and strength.

SPECIAL MACHINING ALLOYS

24S-T4—For simple machine work. Chips long and curled. Stronger than above alloys. Smooth finishes.

61S-T6—Good corrosion resistance, weldability, strength. Lower machinability. Best formability and suited to electro-chemical finishes.

2S and 52S—Higher purity aluminum alloys available for special applications. Have good formability.

REYNOLDS METALS

REYNOLDS *Lifetime* ALUMINUM

CONSIDER ALUMINUM • CONSULT REYNOLDS • THE COMPLETE ALUMINUM SERVICE

LUCAS OF CLEVELAND

Announces...

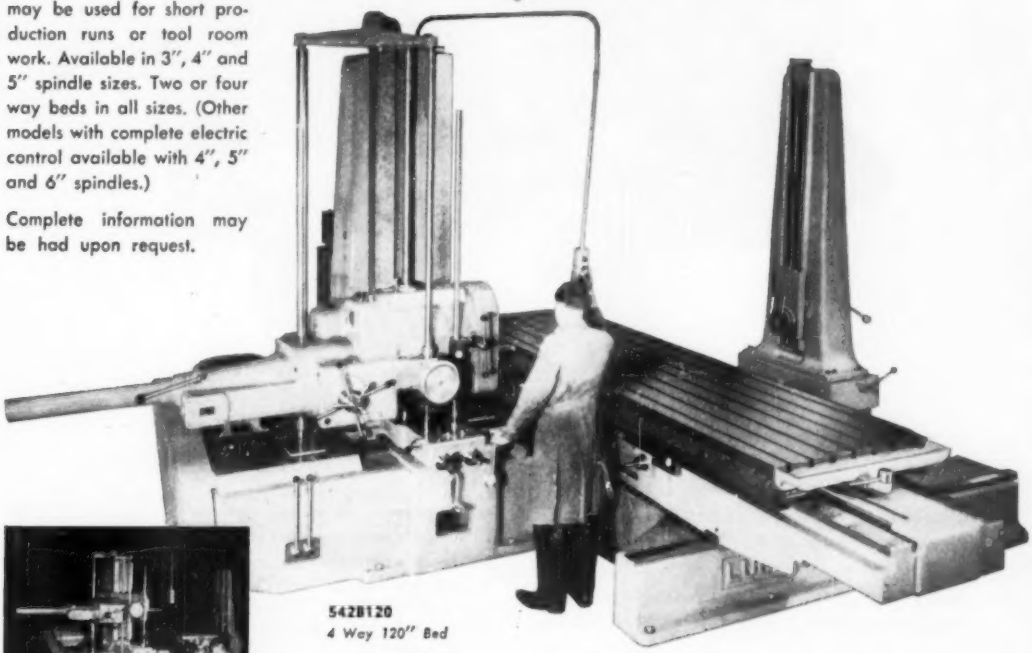
New models

IN 3", 4" and 5" SPINDLE MACHINES

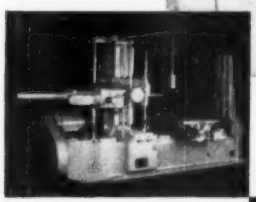
Here is an entirely new series of Horizontal Boring, Drilling and Milling Machines . . . streamlined successors to the rugged, versatile succession of models for which Lucas has been famous 50 years.

Automatic power positioning with simplified, fool-proof controls (available on all models) makes these Series B machines faster on long-run precision production. Standard end measuring rods may be used for short production runs or tool room work. Available in 3", 4" and 5" spindle sizes. Two or four way beds in all sizes. (Other models with complete electric control available with 4", 5" and 6" spindles.)

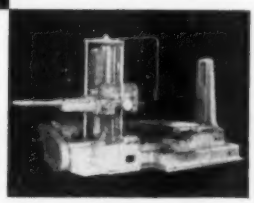
Complete information may be had upon request.



542B120
4 Way 120" Bed



41B24
2 Way 24" Bed



42B60
4 Way 60" Bed

LUCAS *Precision*

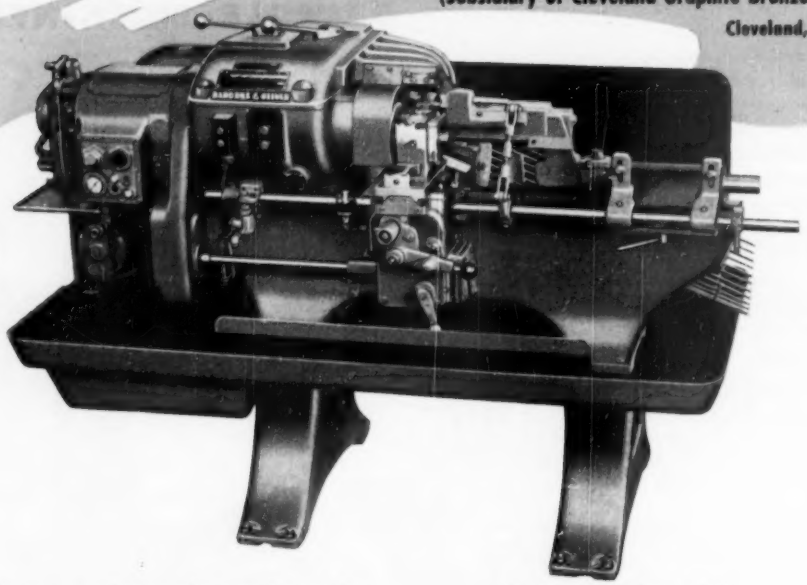
HORIZONTAL BORING, DRILLING AND MILLING MACHINES
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.
CLEVELAND 8, OHIO

LUCAS CLEVELAND

PRODUCTION OF LINER BUSHINGS INCREASED
FROM 600 PIECES PER HOUR
TO 5000 PIECES PER HOUR BY USING THE NEW

BARDONS & OLIVER
No. 32 *Roller Cutter Type* CUTOFF MACHINE

at Harris Products Co.
(Subsidiary of Cleveland Graphite Bronze Co.)
Cleveland, Ohio



In addition to reducing the cutoff time by over 87%, this new machine also outside chamfers both ends of the bushing, thus eliminating a second operation which was formerly required. Furthermore the roller cutting principle saves up to 3/64" of cutoff waste per piece thus producing up to 3% more parts from a given amount of tubing.

Mr. Leslie King, Production Manager of Harris Products Company, has told us he expects his new No. 32 Bardons & Oliver Cutoff Machine will have paid for itself in LESS THAN FIVE MONTHS.

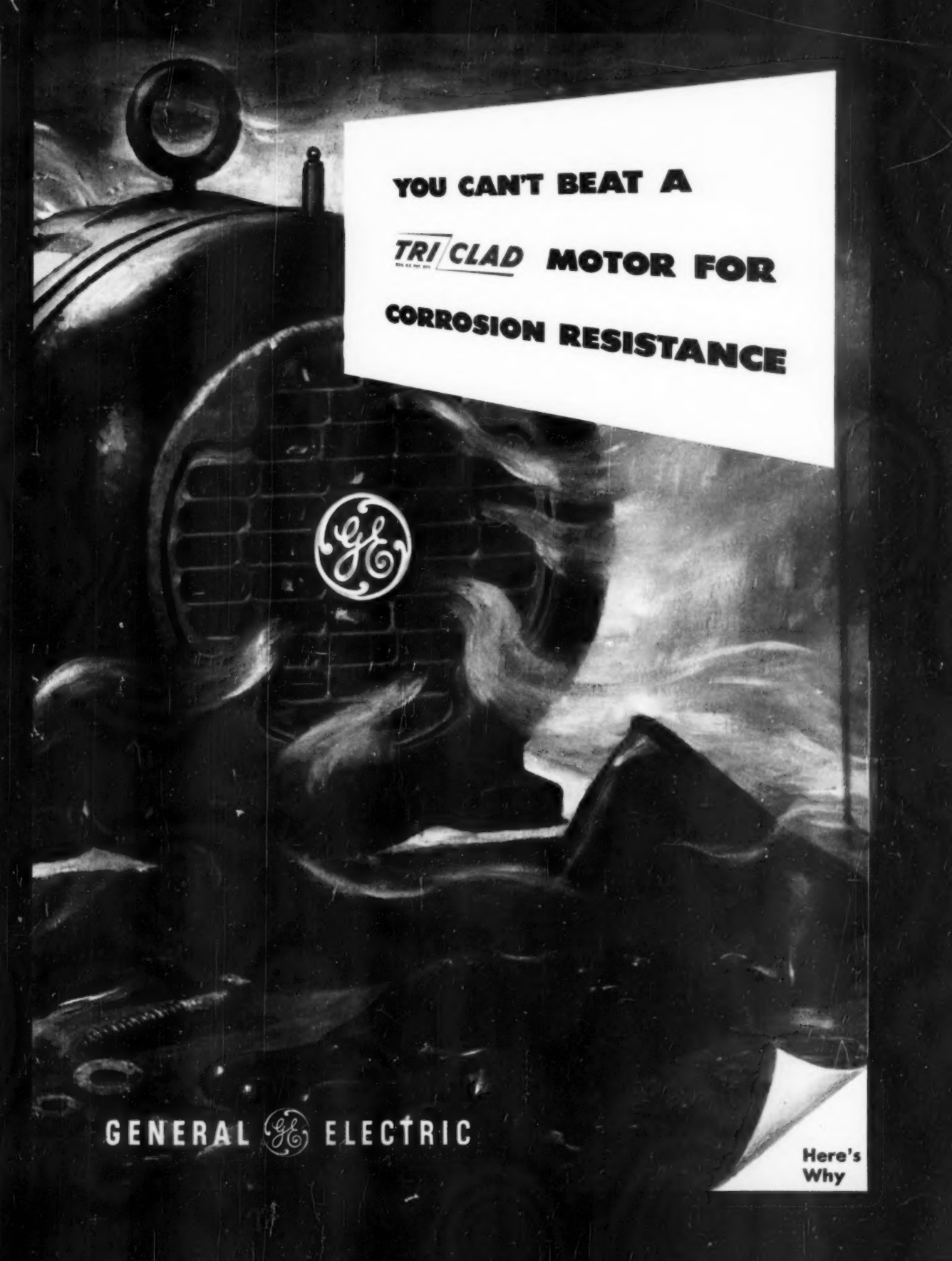
SOME REASONS FOR THIS OUTSTANDING PERFORMANCE

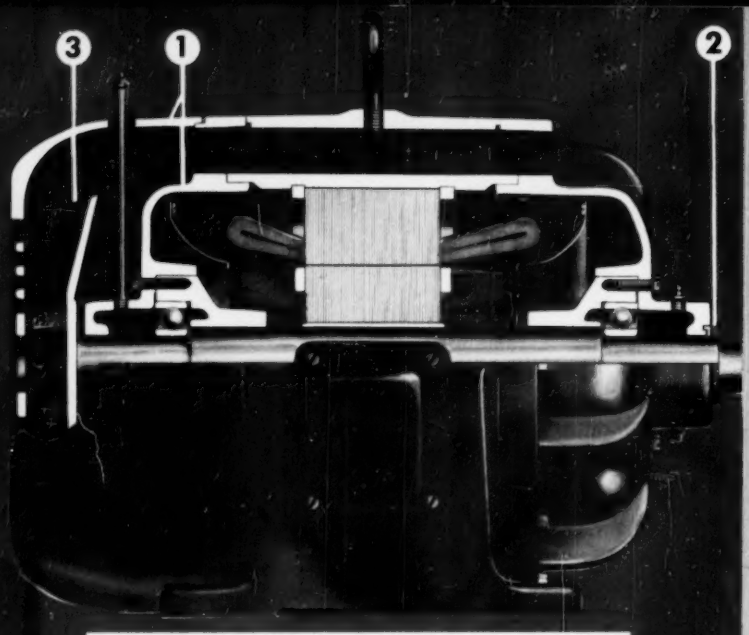
1. Fully Automatic Operation on lengths of work to 12" or more, cut off and chamfered.
2. Available operating rates of over 100 cycles per min.
3. Complete setup changes easily made in 30 to 40 min.
4. 50,000 to 250,000 pieces produced between sharpenings of Roller Cutter.
5. Overall lengths consistently held within a few "thousandths".

The No. 32 Bardons & Oliver Cutoff Machine is ideally suited for use on pipe nipples, pipe couplings, conduit couplings, ferrules, bushings, spacers, and all other tubular products from ¼ inch to 2 inches O.D.

Manufacturers of Turret Lathes and Cutoff Machines

BARDONS & OLIVER, INC.
1133 WEST 9TH STREET • CLEVELAND 13, OHIO


YOU CAN'T BEAT A
TRI CLAD MOTOR FOR
CORROSION RESISTANCE
GENERAL ELECTRIC
Here's
Why



Here's the totally enclosed Tri-Clad double-shell structure (1) that locks out dirt, flying metal chips, abrasive dust and corrosive fumes. Check the rotating labyrinth seal (2) which prevents foreign matter from working in along the shaft. Note the cast-iron housing, the corrosion-resistant G-E Textolite* material cooling fan (3). Fan circulates cooling air between the shells—no contaminated air touches the punchings or inside parts.

You can't beat TRI-CLAD motors for corrosion resistance

Acid fumes, alkali dust, dye-house vapors, tropical weather — you name *your* motor "poison." You just can't beat Tri-Clad cast-iron construction for corrosion resistance.

Rolling up 6 billion hours of service on all kinds of jobs, more than 1,876,000 Tri-Clad motors tell the eye-opening story of cast-iron motor structure. You get an inherent damping action that minimizes noise, and damaging vibration. You get rigidity that makes for permanent shaft alignment. (Try bolting a Tri-Clad motor to an uneven surface — the bolt will snap before you can twist the rigid frame out of line.) You get extra protection against jarring blows and rough handling. You get resistance to rust and corrosion that is not approached by any other metal used for standard motor construction today.

WANT MOTORS THAT STAY ON THE JOB ANWYHERE? There's a stock of Tri-Clad motors near you, in nearly all types and ratings, ready for **IMMEDIATE SHIPMENT**. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

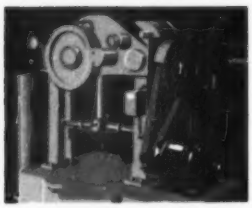
*Reg. U. S. Pat. Off.
(standard on popular sizes)

GENERAL ELECTRIC

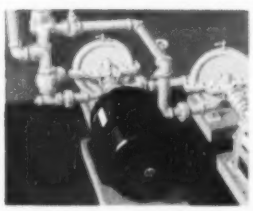
YOU CAN'T BEAT TRI-CLAD EXTRA PROTECTION

G-E capacitor motors for use on fans, blowers, pumps and compressors with single-phase power. From ¼ to 5 hp.

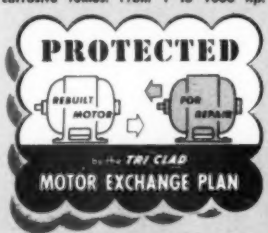
G-E Type ACA induction motors for adjustable speeds—provide speed ranges from 3-1 to 20-1. From 3 to 75 hp.



G-E open (drippreof) induction motors for constant-load, constant-speed applications. From 1 to 2000 hp.

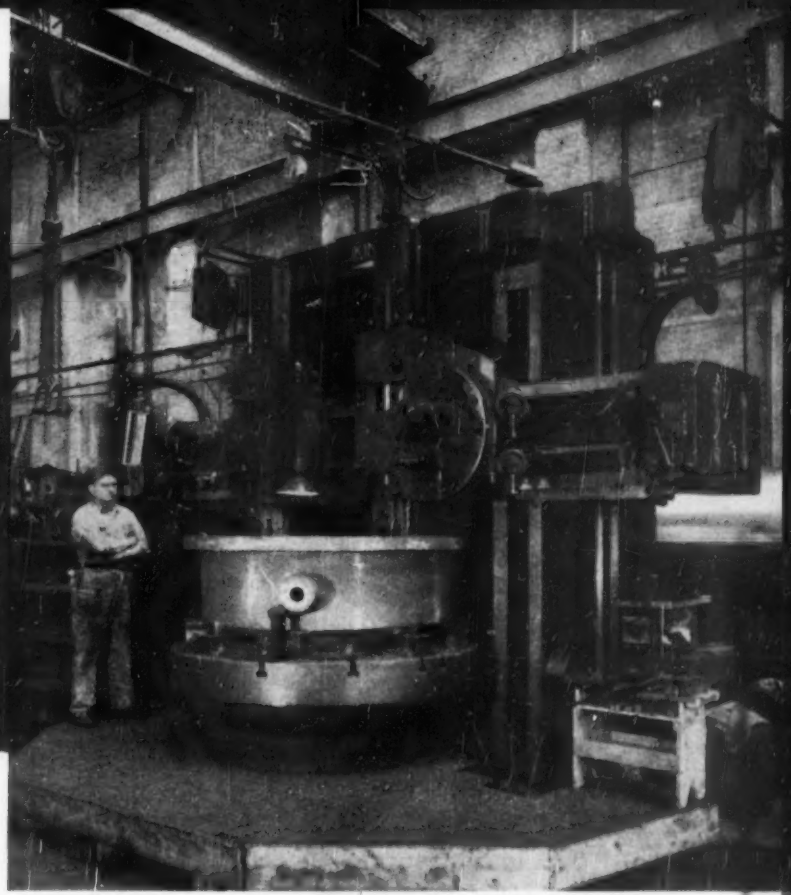


G-E totally enclosed motors for outdoor operation, in abrasive dusts, or corrosive fumes. From 1 to 1000 hp.



Look for this **EXTRA** on the motor you buy!

MACHINING TIME ON VALVE BODIES CUT 66⅔%



— WITH NEW SERIES **KING**

"Machining time on chrome nickel iron butterfly valve bodies has been reduced from 9 hours to 3 hours, with much better accuracy and finish." That is the report of the Henry Pratt Company, Chicago, on the performance of their New Series 72" KING Vertical Boring & Turning Machine shown above. These are not unusual results—they are typical KING results. It's paying others to investigate "The KING Way". Maybe we can show similar savings on your jobs. Complete information available without obligation.

10 SIZES SINGLE COLUMN: 30", 36", 42"—DOUBLE COLUMN: 52", 62", 72", 84", 100", 120", 144". ALL SIZES ARE AVAILABLE IN A WIDE VARIETY OF HEAD COMBINATIONS, WITH OR WITHOUT SIDE HEAD.

SEND FOR NEW CATALOGS

New illustrated KING Catalogs give full description of machines and detailed specifications. Catalog K-1 features Machines sizes 30", 36", and 42"; K-2, sizes 52", 62", and 72"; K-3, sizes 84" and 100"; K-4, sizes 120" and 144". Catalogs requested will be sent promptly.

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

ARMSTRONG

Modern Tooling Calls for *the Correct*

ARMSTRONG TOOL HOLDERS

for each operation

In the old days it was a matter of pride with toolmakers to be able to do the work at hand with the tools at hand. It's a credit to their skill that they could devise to cut threads, do cutting-off and facing, as well as many other operations with one ARMSTRONG TURNING TOOL, but, at today's labor cost, this would be an expensive practice. The maximum of productive work and true machining efficiency can only be obtained by providing the correct ARMSTRONG TOOL HOLDERS for each operation.

The Armstrong System of Tool Holders provides specially designed ARMSTRONG TOOL HOLDERS for every operation on lathes, planers, slotters, and shapers . . . Turning Tools, Boring Tools, Threading Tools, Knurling Tools, Cutting-Off Tools; tool holders with straight shanks, with off-set shanks, rigid tools and "spring" tools . . . special tool holders for high speed steel bits or blades, for ARMIDE (carbide-tipped) Cutters, for ARMALOY (cast alloy) Bits and Blades.

These modern efficient ARMSTRONG TOOL HOLDERS are as available as your telephone for they are carried in stock by your local ARMSTRONG Distributor.

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. ARMSTRONG AVENUE **CHICAGO 30, ILL.**

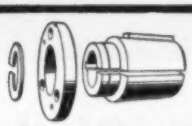
4 BIG ADVANTAGES!

ONE PIECE MOUNTING

Bushing and sheave go on together. One motion mounting. Alignment is easier. Sheave is on right first time.

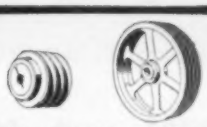
POSITIVE DRIVE

Bushing is keyed to both shaft and sheave. No slipping. No sheared screws. No jammed bushings from bent screws.



FULL CIRCLE GRIP

Bushing split full length with separate collar. Grips shaft full length around full diameter. No forcing or distortion. Grip easily broken. No hammering.



WIDE SIZE RANGE

Magic Grip sheaves are available from 3" pitch diameter up. Style NC bushing for smaller sizes and Style C bushing for larger sizes.

MAGIC GRIP SHEAVE

YOU CAN MOUNT a *Magic Grip* sheave faster than any other sheave you can buy . . . and demount it just as fast. When you mount a *Magic Grip* sheave it runs true. It will not slip or jam. It always comes off easily.

Even if you don't change sheaves often, you should have *Magic Grip* sheaves on every drive to eliminate the possibility of shaft and bearing damage when ordinary sheaves are hammered or pried on or off.

WIDEST V-BELT LINE

Get everything you need for your V-belt drives from one reliable source. *Texrope* offers the broadest line of V-belts, standard and variable speed sheaves and speed changers in the industry. And you also get the extra engineering skill that comes from having more industrial V-belt installations than any other manufacturer.

Get your copy of the 144 page *Texrope* Pre-Engineered Drive Manual from your A-C Authorized Dealer or Sales Office or write for Bulletin 20B6956.

A-5022

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MILWAUKEE, WIS.

Texrope and *Magic Grip* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

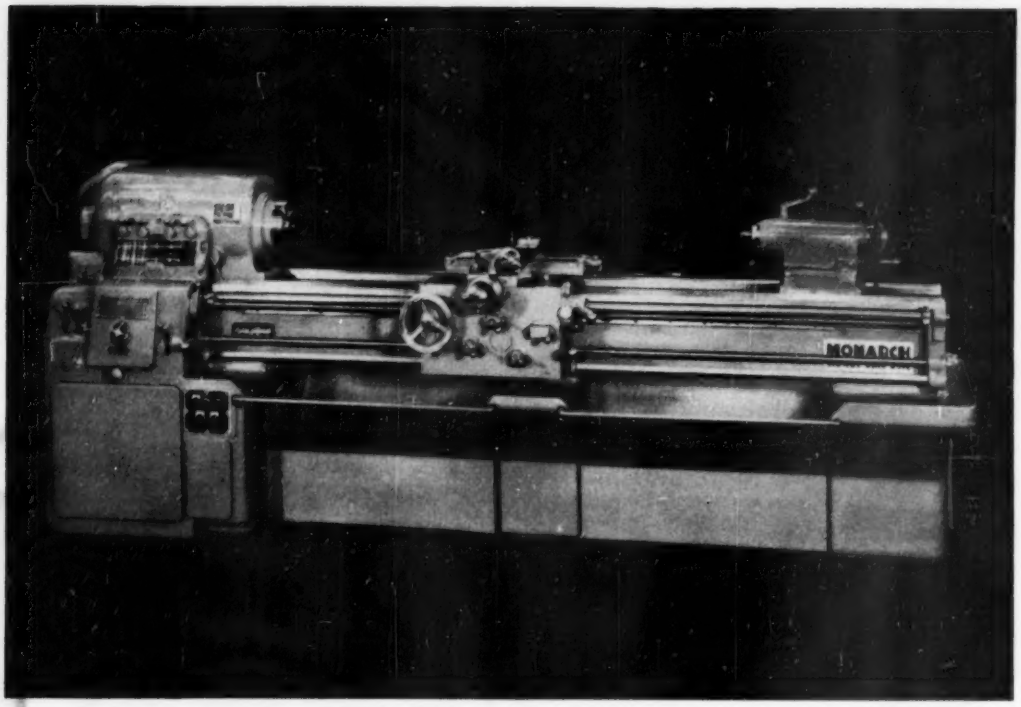
Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.



NOW—A NEW 12″ LATHE
—in the Famous Series 60 Family

For the first time, here is a 12″ machine that offers the many time-tested features of the Monarch Series 60 design. With this announcement we bring within reach of all users the same operating and maintenance economies that have been proved in use on the 14″, 16″ and 20″ sizes.

The new 12″ lathe is available in both engine and toolmakers' models. Like all Series 60 machines, it offers the insured performance of automatic lubrication to the headstock, apron, carriage bearing on the ways, compound bottom slide bearing on the carriage, end gearing and gearbox. All bearings are of the anti-friction type—an improvement pioneered by Monarch many years ago.

These and many other design and construction features mean more savings with Monarch's Series 60 Machines, now available in all four sizes. For complete information, write for Booklet 1113.

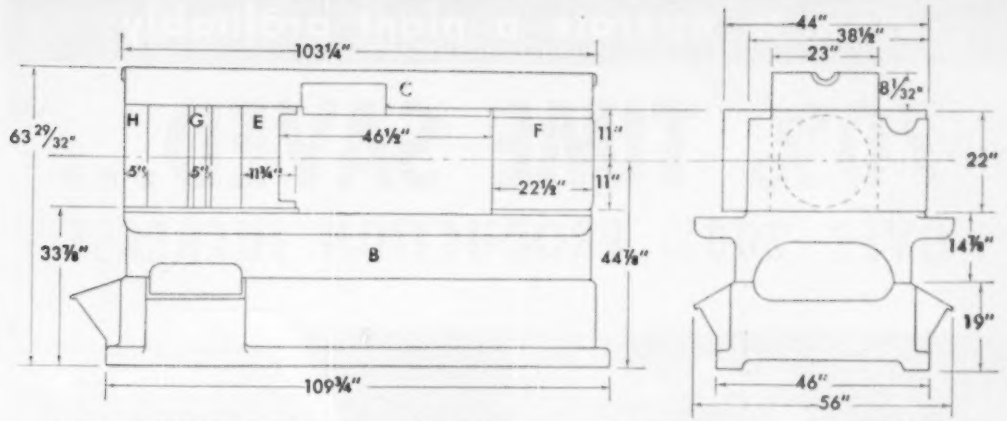
THE MONARCH MACHINE TOOL CO.
SIDNEY, OHIO

You'll Save on Maintenance and Operating Expense With These Series 60 Features:

1. Totally-enclosed gearbox and end gearing—preserves accuracy.
2. Automatic pressure lubrication—insures long life at original efficiency.
3. All anti-friction bearings—for peak power and less maintenance.
4. Hardened, ground or shaved, wide helical gears in headstock—for precision power, easier shifting.
5. American Standard Camlock Spindle Nose—for quick, rigid chuck and fixture mounting.
6. Flame-Hardened and Ground Bedways—preserves accuracy—proved on over 25,000 Monarch Lathes.
7. Induction hardening of many critical parts—for long, trouble-free life.

ACCURACY · ECONOMY · LONG LIFE
Monarch
TURNING MACHINES

FOR A GOOD TURN *FASTER*—TURN TO MONARCH



H, G, E — HEADSTOCK SUPPORTS Weight — 1233 lbs.

B — BASE Weight — 6655 lbs.

C — TOP BED Weight — 1232 lbs.

F — GEAR BOX Weight — 841 lbs.

BE VALUE WISE OR OTHERWISE

True of any "means goods," the purchase price of any Multiple Spindle Bar Automatic is only relative. It is "high" or "low" on the basis of the total cost of its total services, compared to other brands. Important items of total cost are those of operation and maintenance.

Machine analysis will invariably disclose the low cost operation and maintenance features that have been "built into" a machine. Such features are built into the CONOMATIC, beginning with its very foundation. The figures above substantiate the claims below.

THE 1½" Six Spindle MACHINE FRAME:

1. **Provides greater capacity for handling work.**

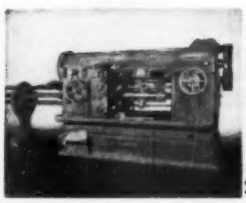
   The Frame provides a LONGER TOOLING AREA, with more positions and accommodations for tooling and attachment applications, with more clearance and conveniences for faster tool setting, than are provided by any other "automatic."

2. **Provides better support to work and tools.**

   The Frame provides better support and alignment to headstock members, tool slides, and other units and mechanisms, with BASE SUPPORT CLOSER TO THE WORK AXIS, with BETTER TOP BED SUPPORT TO SHORTER, "WEAVE PROOF," UPRIGHTS, and, with larger, heavier, and stronger, Top Bed and Base, than are provided by any other "automatic."

3. **Provides greater accessibility for lower cost operation and maintenance.**

   The Frame provides a more orderly arrangement of, and easier access to, all units, mechanisms, parts, and adjustments, than can possibly be provided by any "automatic" that does not have a VISIBLY ACCESSIBLE, NON-INTERFERING CAM SYSTEM.



Buyer's Comparison Chart will guide you to full information

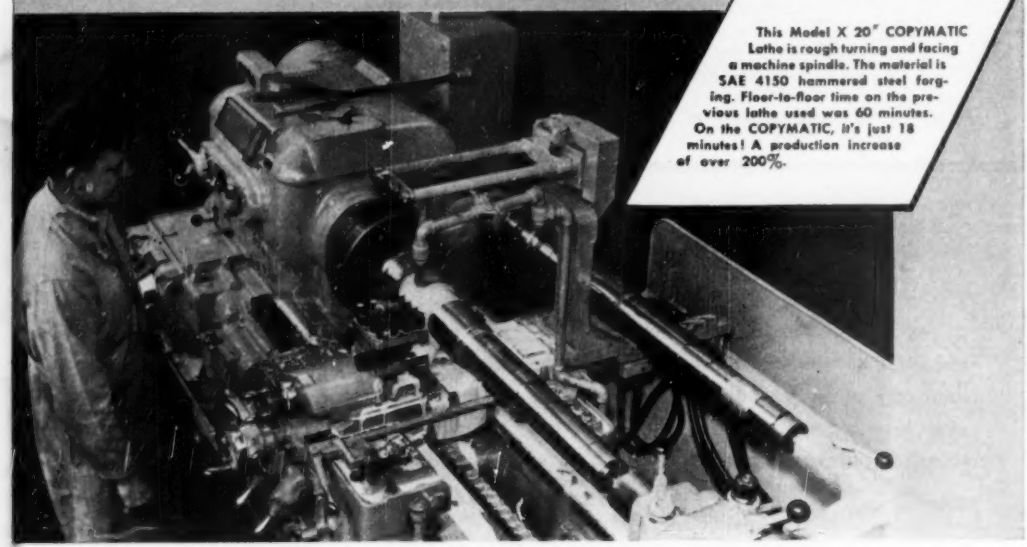
A Comparison of ALL Automatics is in Favor of Cone

Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

How to operate a plant profitably:

70% TIME SAVED...
OVER 200% PRODUCTION INCREASE



This Model X 20" COPYMATIC Lathe is rough turning and facing a machine spindle. The material is SAE 4150 hammered steel forging. Floor-to-floor time on the previous lathe used was 60 minutes. On the COPYMATIC, it's just 18 minutes! A production increase of over 200%.

...with a Lodge & Shipley Copymatic Lathe!

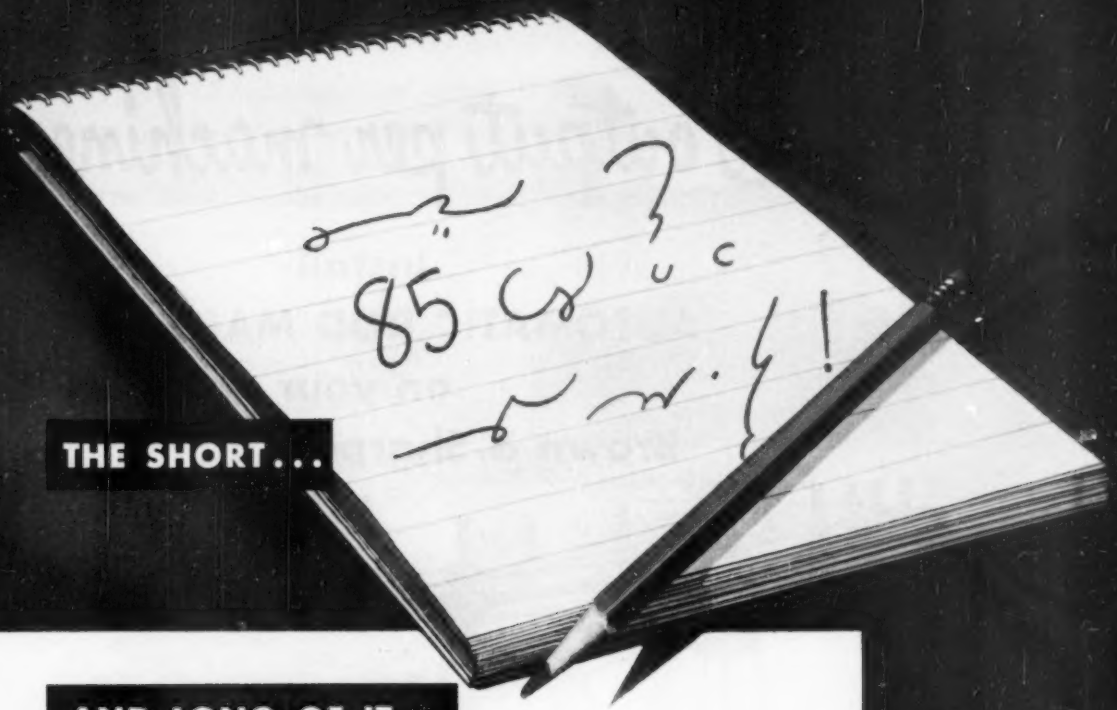
Too often, failure to replace machinery means failure to produce profitably. Length of service or age is not the only factor to be considered. Lathes only a few years old may be badly outmoded when compared with new, improved machines *on a productive basis.*

The versatility and productive capacity of the COPYMATIC highly recommends it as an economical replacement. In case history reports, *by the owners,* Lodge & Shipley COPYMATICS outproduce competitive machines by significant margins. At Link-Belt Co., "Turning time cut ½." At Otis Engineering Corp., the COPYMATIC is "1st choice . . . saves 30% of time." At Continental Motors Corp., "lower tooling cost—speedy changeover." At Wyman-Gordon Co., "A time saving of 50% over other lathes."

Your Lodge & Shipley representative will gladly show you how COPYMATICS will actually save you money, speed and improve production at the same time. For details on the COPYMATIC, ask for Bulletin No. 673.

Before buying any lathe, check especially the "profit features" proved important by Lodge & Shipley users. Write for new booklet No. 200 C. L. giving detailed information on Lodge & Shipley "Profit Features."

THE Lodge & Shipley COMPANY
MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO



THE SHORT...

AND LONG OF IT...

Cimcool covers 85% of all metal cutting jobs!

And the *best* of it, this revolutionary cutting fluid does a *better job!*

The reason? Cimcool° is different. It's a *chemical emulsion* that replaces all water emulsions and all but a few highly compounded specialty oils. Jobs are completed faster—better—because Cimcool combines friction reduction and cooling capacity in a degree never attained by old fashioned cutting fluids.

Furthermore, you get longer tool life, and there's less down time. Cimcool is longer lasting in machines, too . . . and reduces the cost of cleaning and changing. And Cimcool permits faster speeds.

We sincerely believe one test run will convince you. For a demonstration in one of your own machines, just write us and we'll have one of our Cincinnati Milling-trained machinists call on you—without cost or obligation. Or if you prefer, send for our free booklet "Cimcool Gives the Answers." Address, Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Company, Cincinnati 9, Ohio.

°Trade Mark Reg. U.S. Pat. Off.

A Production-Proved Product of
THE CINCINNATI MILLING MACHINE CO.

for 85%
OF ALL METAL CUTTING JOBS

Boost net output per machine

Install
AUTOMATIC ROD MAGAZINES
on your
Brown & Sharpe Automatics

3 EFFICIENCY-BOOSTING ADVANTAGES

- Magazine inserts bar automatically as needed . . . in minimum amount of time.
- Greatly simplified restocking provides ample time for operator to supervise quality and finish of work more closely . . . and on more machines.
- Increased net production more nearly approaches gross or geared output.

BROWN &

BETTER WORK — LOWER COSTS

With the Automatic Rod Magazine, a screw machine operator is free to check work pieces more frequently and to pay closer attention to tool conditions . . . maintaining desired quality and producing parts at a minimum cost.

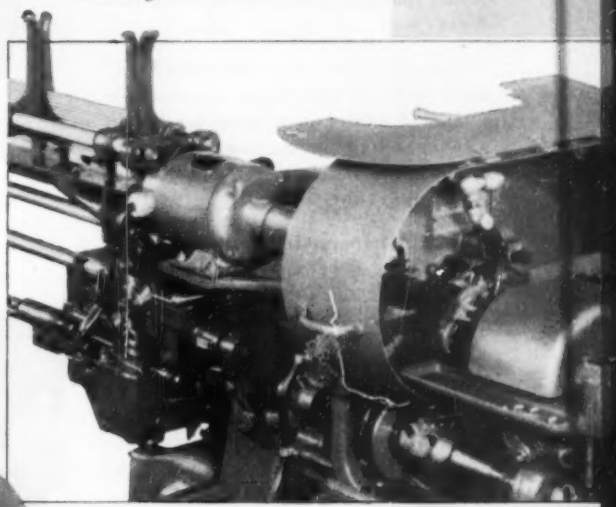
INCREASED OPERATING EFFICIENCY

Here's how the Brown & Sharpe Automatic Rod Magazine increases operating efficiency. (1) The magazine permits loading of stock at any time (2) The feeding mechanism takes a new rod automatically the instant it's needed and feeds it into position for trimming.

Electrically-controlled magazines are made for Brown & Sharpe Nos. 00G and 0G Automatic Screw and Cutting-Off Machines . . . also for Automatic Screw Threading Machine. Mechanically-operated magazine is made for No. 2G Machine. Magazines take commercial 10 ft. bars; 12 ft. capacity available.

Investigate the production advantages of Automatic Rod Magazines for your plant. Send for complete information. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

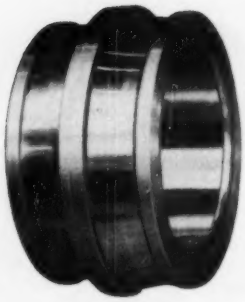
Compare the production value of these two screw machines. The machine at left permits practically constant operation because it is equipped with an Automatic Rod Magazine. The regularly equipped machine at right loses production because operation is periodically delayed by need for manual restocking.



Every 3½ minutes this Automatic Screw Threading Machine consumes a 10 ft. bar, ¼" diam., in making screws like those shown at left. Its Automatic Rod Magazine holds 33 of these bars — two hours' supply. Magazine can be reloaded any time during this period. Without magazine, reloading involves over 15 interruptions an hour, making operation of more than two machines and close work-supervision difficult for one operator.

SHARPE B·S

SKF RACES *Against Time...*



with the new

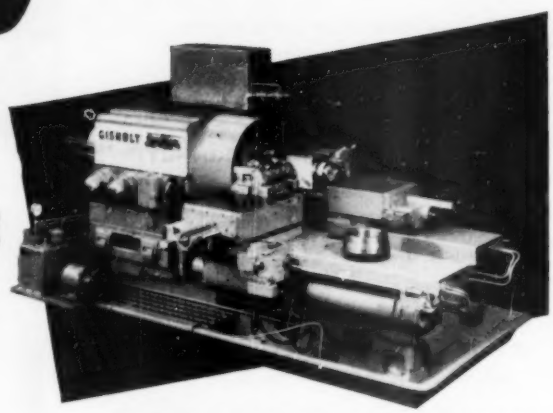
GISHOLT NO. 24 HYDRAULIC AUTOMATIC LATHE

When it comes to fast production of top quality spherical roller bearing races, SKF doesn't fool.

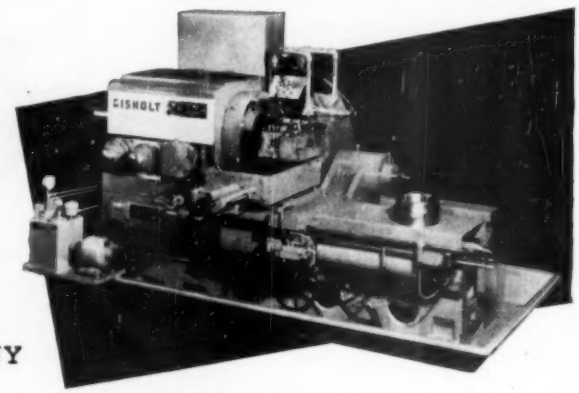
These new Gisholt No. 24 Hydraulics remove 34 lbs. of metal in two operations in a total of only 2.80 minutes' machining time on each of two machines. All cutting is on 52100 bearing steel and done at speeds of 325 to 350 f.p.m.

Speed is important, of course. But precision is the governing factor. How the Gisholt No. 24 does the job is a story that might mean real savings for you, too.

The No. 24 Hydraulic Automatic Lathe is a larger version of the famous No. 12 that has an outstanding success record on hundreds of jobs. If you have large volume precision work up to 24" diameter, the Gisholt No. 24 is the machine to investigate. Write for full information.



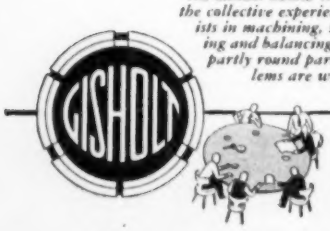
First Operation: Chucked on OD with 3-jaw hydraulic chuck, part is turned up to the jaws, faced, chamfered, bored and bore radius formed. Cam relief on rear tool block turns boring bit clear of workpiece as it is withdrawn.



Second Operation: Part held on expanding arbor by hydraulic pressure is finish turned, faced, chamfered and bore radius formed. Special rocker arm type carriage at rear tips in shaving tools to form both roller grooves with feed of .003" to .0045."

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

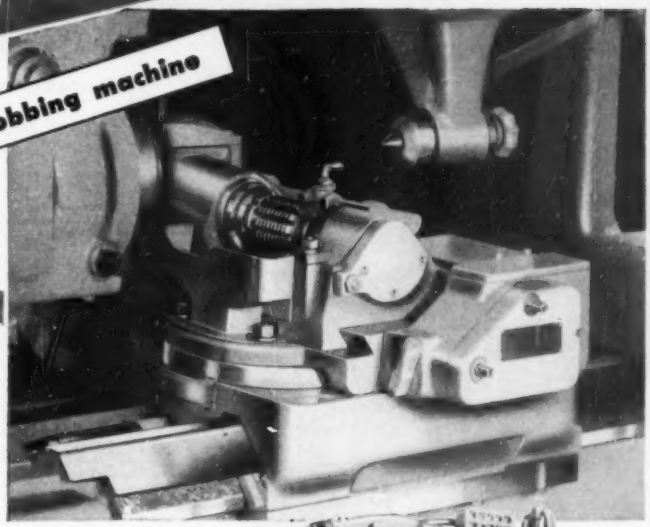


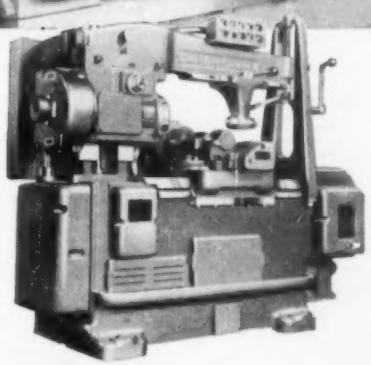
TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

AUTOMATIC HOB SHIFTING

on no. 16-16 hobbing machine

IMPROVES TOOL LIFE, FINISH





● Actual field experience on the improved No. 16-16 Hobbing Machine, equipped with automatic Hob Shifter, shows greatly improved gear tooth accuracy and finish, with much longer hob life.

One plant operating these new machines already reports 1060 pieces per hob sharpening, compared with 850 pieces formerly obtained with manual shifting. Excellent finish is produced on pre-shave gears, with lead variations holding within .0001″ to .0003″.

Results show the importance of automatic hob shifting for reducing tool maintenance and establishing quality output on a competitive basis. Performance such as this places conventional gear cutting machines in an uneconomical position.

Call your Barber-Colman representative today for additional information on the improved No. 16-16 Hobbing Machine.

Complete Data

is contained in this new Catalog describing features and improvements of this machine. Write for your copy now. Bulletin 6132.

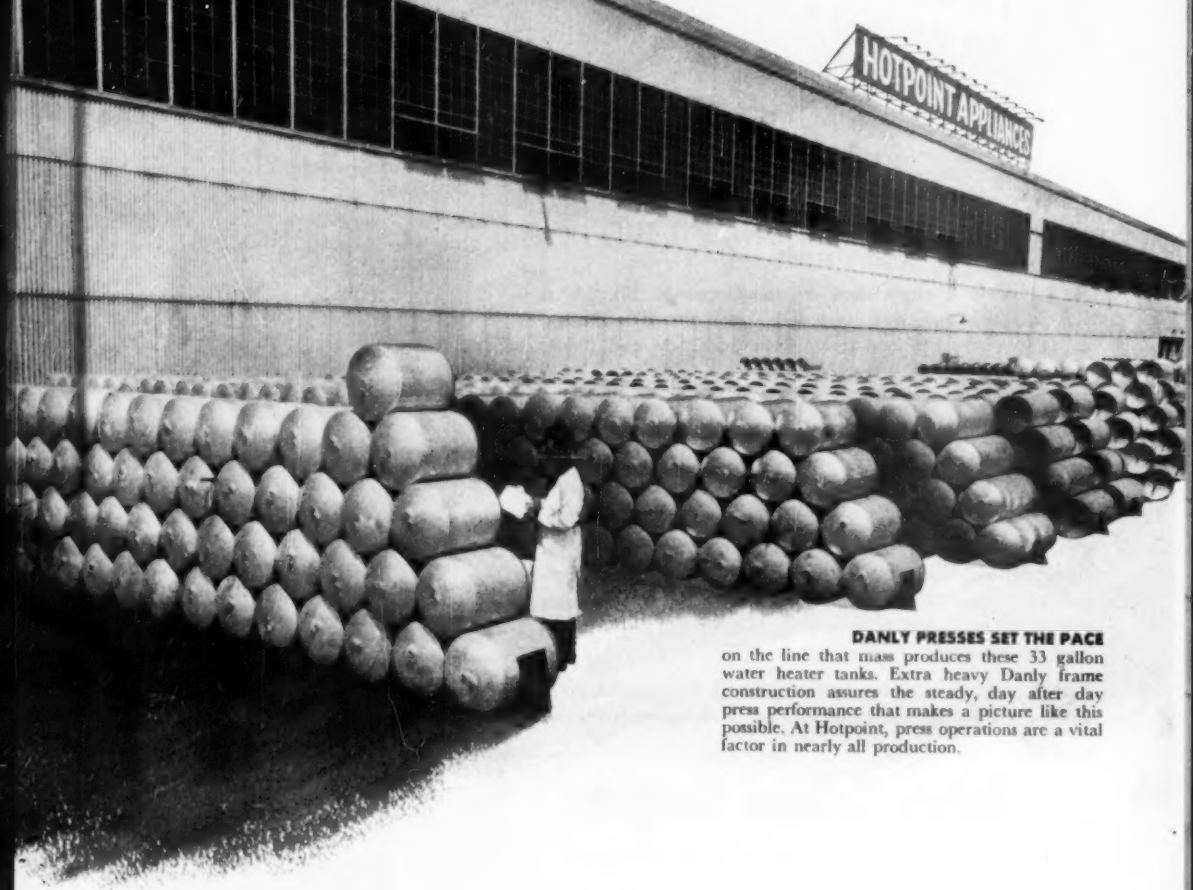
Barber-Colman Company

GENERAL OFFICES AND PLANT, 6122 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

DANLY PRESSES

PAY OFF AT HOTPOINT—

. . . in plant 5 at Milwaukee where press work is the key to efficient, high speed production of electric water heaters and automatic dishwashers.



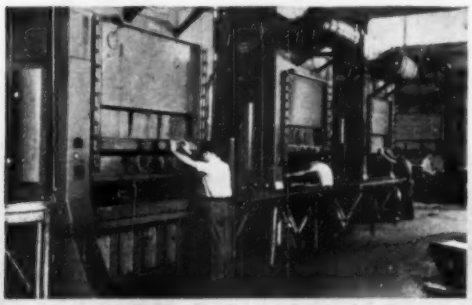
DANLY PRESSES SET THE PACE on the line that mass produces these 33 gallon water heater tanks. Extra heavy Danly frame construction assures the steady, day after day press performance that makes a picture like this possible. At Hotpoint, press operations are a vital factor in nearly all production.

Special Danly Press construction and engineering features assure the uninterrupted performance so important wherever production schedules run close to actual machine capacity. Just one of these features, the new Danly cool-running clutch, reduces clutch wear—a major cause of press down time. In over two years of operation, the Danly Presses at Hotpoint have required no major clutch maintenance . . . no relining and only 1 take-up!

Other outstanding Danly Press features include complete pressure lubrication and a specially designed control system. Write today for the new Danly Straight Side Press Catalog—check the specific advantages of Danly Presses in your plant.

JUST AS IT COMES FROM THE MILL, steel goes into production. The skidded stacks are simply unstrapped and fed directly to the Danly Press for blanking. The incoming steel storage area immediately adjacent to the beginning of the production line cuts down on costly material handling and simplifies stock control.

AT THE HEAD OF THE TANK LINE, the first operation is performed in this 500-ton Danly Press . . . a good way to start production! Tank Ends are blanked from 3/16" hot rolled steel in a 1 stage die at a rate as high as 220 pieces per hour. The circular blanks produced are approximately 22" in diameter.



. . . AND MAINTAIN THE PACE! This bank of four 250 ton Danlys, in addition to performing general purpose stamping operations, works almost continually to "take up the slack" in the entire stamping production schedule. Whenever production lags on one part or another, these Danly's keep the assembly line rolling. The fourth press in series is set at right angles to the others to increase flexibility of conveyor layouts.

SUPERVISING QUALITY assures high working standards and precision. Here, details of a reinforced water heater bottom stamped in three operations on a series of Danly Presses are checked. An interesting highlight is the quality control sample board in the background. The stamped parts are properly coded to provide a quick running check on die performance. New samples taken at frequent intervals give a true picture of current production quality.

DANLY®

It Costs Less to Run a Danly Press!

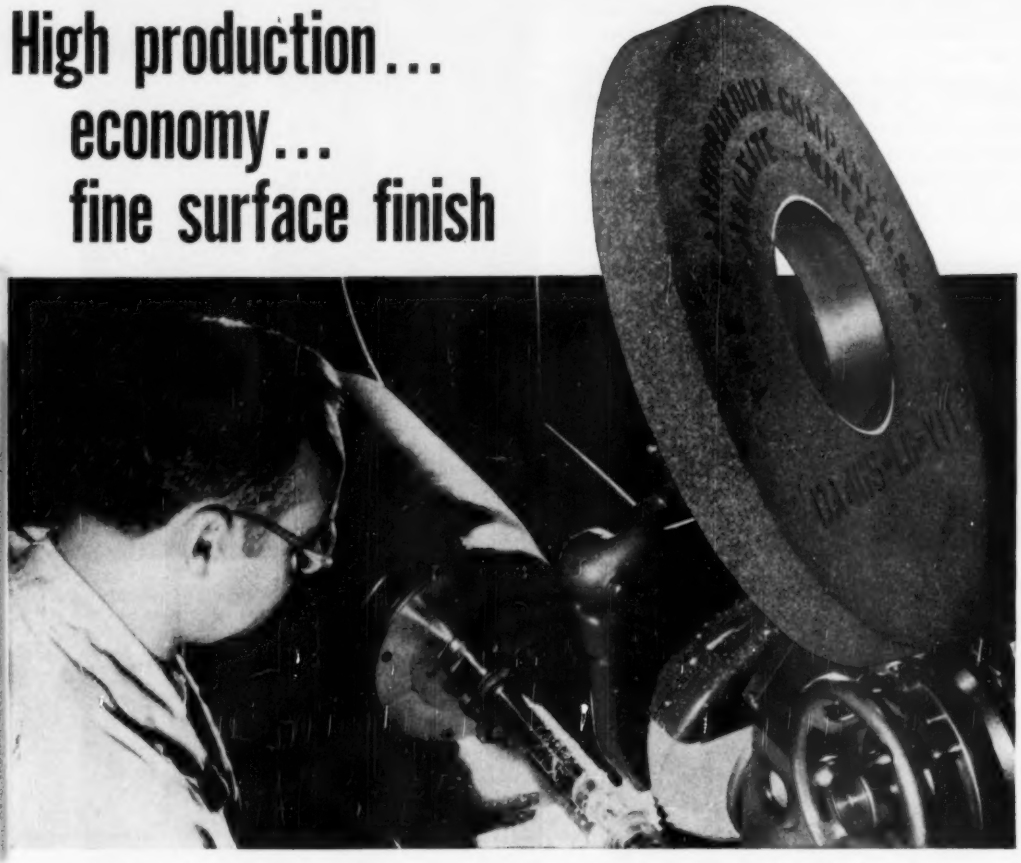
DANLY MACHINE SPECIALTIES, INC.

2100 SOUTH LARAMIE AVENUE, CHICAGO 50, ILLINOIS

MECHANICAL PRESSES . . . 50 TO 3,000 TONS

V 11 BOND Cylindrical Grinding Wheels

High production... economy... fine surface finish



V 11 Bond wheels by CARBORUNDUM offer cost-cutting production advantages in a wide variety of cylindrical grinding applications. A cool, free-cutting action is obtained because the physical properties of these wheels provide outstanding grinding characteristics. Reduced grinding pressures result in exceptional form holding qualities, greater accuracy, and faster cutting rates. Long service is secured by a self-dressing action.

One of these versatile wheels may be used to grind a large variety of materials. Or, it may be used for both heavy cuts and fine finishes. Wheel change set-up time is saved. Inventories of special and premium abrasives are minimized.

For complete details on the economical and efficient application of V 11 Bond wheels in your cylindrical grinding operations, ask your distributor for a copy of our new booklet or write direct. Bonded Products Division, The Carborundum Company, Niagara Falls, New York.

BRANCH OFFICES IN:

Atlanta	Detroit
Boston	Los Angeles
Buffalo	Jersey City
Chicago	Philadelphia
Cincinnati	Pittsburgh
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San Francisco	

Bonded Abrasives by

CARBORUNDUM

TRADE MARK

Making **ALL** *abrasive products... to give you the proper* **ONE**

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

the LeBlond Clipper

NEW AUTOMATIC HIGH SPEED MANUFACTURING LATHE

Automatic action thru a complete cycle

3 headstocks to choose from

Delivers speeds up to 3600 rpm

Efficient combination of speed and power

Can be operated semi-automatically or manually

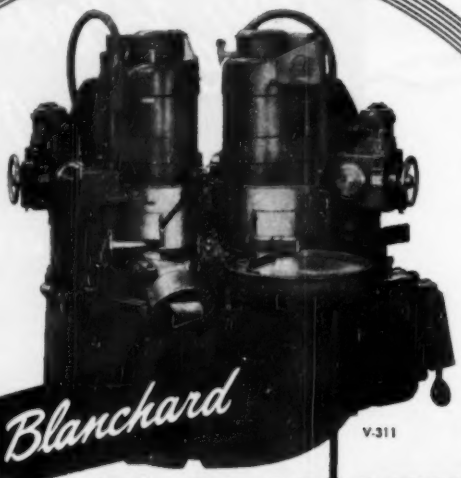
One operator can tend several Clippers

Back facing attachment optional

write for Clipper bulletin today

THE R. K. LeBLOND MACHINE TOOL COMPANY, CINCINNATI 8, OHIO
LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES.
SALES OFFICES: New York, Chicago, Detroit.

LeBLOND

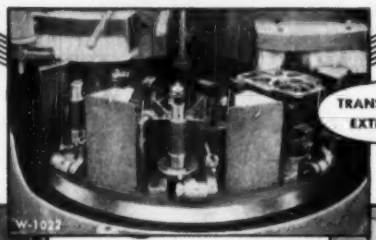


Put them on a Blanchard

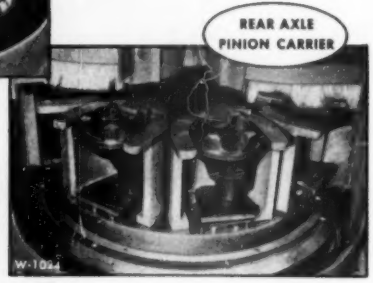
NO. 16-A2 AUTOMATIC

This two-spindle surface grinder is a real producer. In a single pass, the work is roughed by one wheel and then finished by the second wheel. Because each wheel can be selected for its part of the grinding operation, without having to compromise between roughing and finishing, the No. 16-A2 is particularly suited to work requiring high production. Close limits are assured by automatic size control for each wheel. If you're looking for maximum results with minimum effort, get production details on just how fast your own work can be done on the No. 16-A2.

Send blueprints or samples — there is no charge or obligation.



The joint face is ground by loading the cast iron part over a post, locating from a shoulder, supporting the flange by a spring bunter. It is clamped automatically. Parts are held flat to .001", square with bore to .002", and to ±.001" for size. 84 pieces ground per hour on one side.



These cast iron caps are placed in suitable stations, automatically clamped, ground, and automatically unclamped. 1020 caps per hour are ground to ±.003", and flat to .002" in a 20 station fixture. 1/16" of stock is removed per side.

Send for your free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

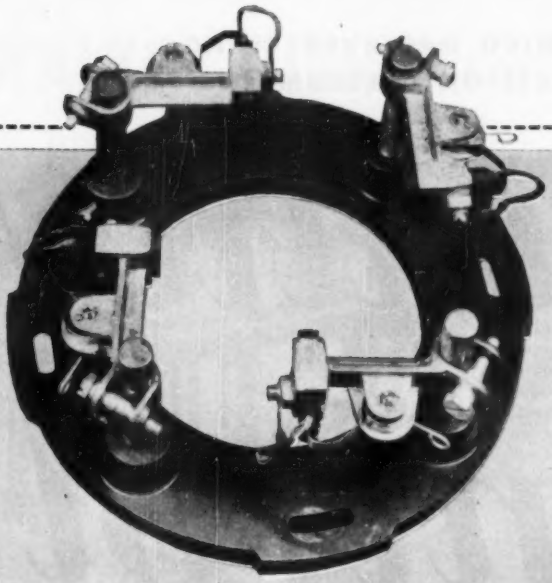
These cast iron parts are loaded with the flange under a "U" shaped block, clamped upward against the block. The four bearing surface "feet" are ground to limits of ±.003", parallel to flange within .001". 229 pieces are ground per hour on one side.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Something ***NEW*** *has been added to...*

SK DEPENDABILITY

Arcs leave no tracks on this *MELAMINE* ring

When conducting dust collects across the surface of a rocker ring, it can cause a flashover. In the case of ordinary materials used for rings, this arc carbonizes a path into the ring itself. Thus, when the machine is cleaned to remove conductive particles, the path or track cannot be removed. High resistance grounds result. Motor efficiency is lost.

But, carbon flashovers don't have a chance on this Melamine ring. It's arc proof... noncarbonizing. There is no tracking effect ... no "burned-in" paths to cause shorts. Thus, when you wipe the ring clean, it is restored to full service condition. Top motor efficiency is maintained.

That is one reason why the Life-Line SK offers users of d-c motors new dependability. Cast brass brushholders are another. They are noncorroding ... have no bearings to wear or bind. No moving parts to get out of adjustment. A stainless steel spring maintains perfect brush contact through constant tension.

There are other reasons, too. Ask your Westinghouse representative to show you the inside story of the Life-Line SK motor. See the "Transvision" presentation. It takes the SK apart and puts it together again at your own desk. You'll see why something new has been added to SK dependability. Call your local representative today. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-21555

Westinghouse

Life-Line

D-C Motors

TUMICO HAS EVERYTHING
IN PRECISION INSTRUMENTS FOR

Quality Control

If it's big outside, say up to 168", measure it accurately with a giant 14 foot Tumico Bar Micrometer.

If it's small inside, say down to 200 thousandths diameter, Tumico has the inside micrometer to measure it accurately.

And in between Tumico has calipers, gages, micrometers and every other precision instrument needed for fast, accurate measuring.

See your dealer, or write us direct for literature.

TUBULAR MICROMETER COMPANY
St. James, Minnesota • U.S.A.

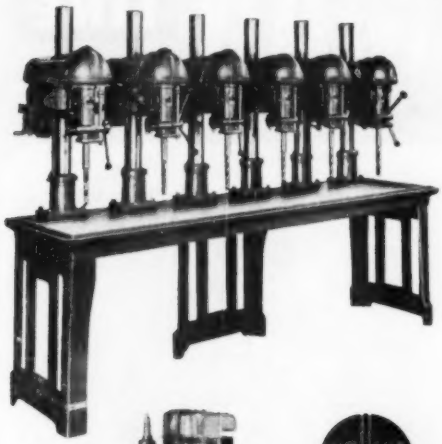
FEATHER TOUCH
TUMICO

SEATTLE • LOS ANGELES • DENVER • DALLAS • CHICAGO • DETROIT
MINNEAPOLIS • KANSAS CITY • ATLANTA • NEW YORK • TORONTO, CANADA
EXPORT OFFICE: CHICAGO

Cut your production costs

WALKER-TURNER *designed* DRILL PRESSES

cover a wide range of models, speeds, service



20" DRILL PRESS 6 Spindle, Hand Feed

5 Speeds: 400, 800, 1200, 1800, 2600 (using a 1740 r.p.m. motor).
Spindle Travel: 6".
Capacity: 1".
Head Construction: one-piece gray iron casting, line-bored for greater accuracy.

For the industrial user where the production rate and initial cost are primary factors. Particularly effective in increasing production on many jobs where a series of holes are to be drilled, tapped, reamed or counterbored in a single piece. Other multiple-spindle models from 2 to 6 spindles.

RADIAL DRILL PRESS

15 Spindle Speeds: 110-5400 r.p.m. (using an 1140 r.p.m. motor) 160-8300 r.p.m. (using a 1740 r.p.m. motor).

Ball bearing thrust collar carries head and ram assembly —drill can be tilted in either direction, to any angle up to 45°. Drill head, ram and cradle may be swung in a complete circle around the column.

A quick-action lock secures drill in any position, and assures minimum amount of deflection.

The Walker-Turner Radial Drill Press handles all drilling and tapping jobs up to ½" in cast iron with the efficiency of a larger machine where capacity may be wasted on the small job. Particularly valuable wherever large, cumbersome or heavy pieces of work make it easier to move the drill head rather than the work.

15" PRODUCTION MODEL

4 Speeds: 600, 1250, 2440, 5000 r.p.m.
Spindle Travel: 4¼".
Capacity: 18½" chuck to table.
Head Construction: one-piece gray iron casting, line-bored for greater accuracy.
Compact, portable: can be located in assembly lines, reducing handling costs.

Adaptable for sanding, grinding, mortising, shaping and many other metal and woodworking operations. Bench and floor models.

SEE YOUR LOCAL DEALER for complete specifications on these and other metal and woodworking power tools in the complete Walker-Turner line, or mail coupon for new catalog.

SOLD ONLY THROUGH AUTHORIZED DEALERS

KEARNEY & TRECKER MILWAUKEE

WALKER-TURNER DIVISION
PLAINFIELD, NEW JERSEY

WALKER-TURNER DIVISION
Kearney & Trecker Corp., Dept. AM8, Plainfield, N. J.
Please send me a copy of the complete Walker-Turner Catalog.
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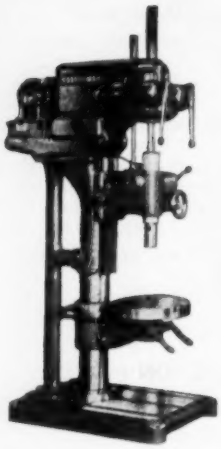
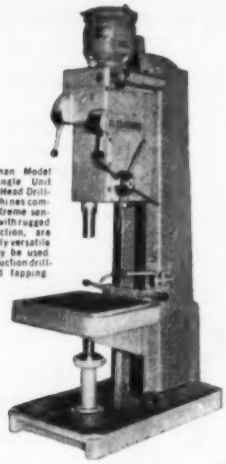
DRILL PRESSES • RADIAL DRILLS • TILTING ARBOR SAWS • BELT and DISC SURFACERS
METAL-CUTTING BAND SAWS • LATHES • SPINDLE SHAPER • JOINTERS

THE CLEEREMAN LINE

OF PRECISION JIG BORERS and DRILLING MACHINES

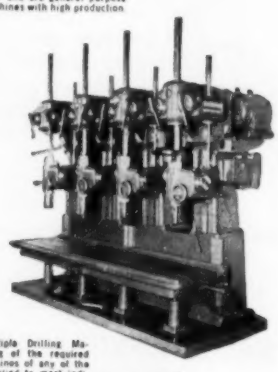


Cleereman Round Column Drilling Machines produce accurate holes at high speed and at low cost and are general purpose machines with high production.



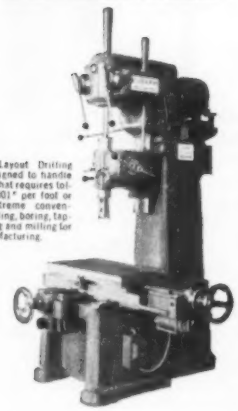
Cleereman Model 325 Single Unit Sliding Head Drilling Machines combine extreme sensitivity with rugged construction, are extremely versatile and may be used for production drilling and tapping.

Cleereman Jig Borers, noted for unexcelled precision, extreme accuracy, ease of operation in small lot production and in producing tools, dies, jigs & fixtures. Models available with electrically controlled preselection.



Cleereman Multiple Drilling Machines consisting of the required number of machines of any of the three types supplied to meet individual requirements.

Cleereman Box Column Drilling Machines have an exceptionally rigid construction for continuous heavy duty work combined with accuracy and the speed required for low cost production.



Cleereman Layout Drilling Machine designed to handle layout work that requires tolerances of .001" per foot or broader. Extreme convenience for drilling, boring, tapping, reaming and milling for jigless manufacturing.

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400 West Madison Street, Chicago 6
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Affiliated with—

CLEEREMAN MACHINE TOOL CO. Green Bay, Wis.

BUILDERS OF PRECISION JIG BORERS & DRILLING MACHINES

"no more GAMBLING on tool steel selection"

[⅓ actual size; Selector is in 3 colors]

Since the first announcement, hundreds of tool steel users have received their CRUCIBLE TOOL STEEL SELECTORS. The comments received indicate that this handy method of *picking the right tool steel right from the start* is going over big.

"Handiest selector I've ever seen"

"No more gambling on tool steel selection"

"You're right, the application should dictate the choice of the tool steel" . . . and many, many more favorable comments.

You'll want your CRUCIBLE TOOL STEEL SELECTOR. It uses the only logical method of tool steel selection—begin with the application to pick the right steel! And the answer you get with one turn of the Selector dial will prove satisfactory in every case, for the CRUCIBLE TOOL STEEL SELECTOR covers 22 tool steels which fit 98% of all Tool Steel applications. ALL the tool steels on the Selector are in Warehouse Stock . . . that means when you get the answer, you can get the steel . . . fast!

Write for your Selector today! We want you to have it, because we know you've never seen anything that approaches your tool steel problems so simply and logically. Just fill out the coupon and mail. Act now! CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

Here's how it works:

To use the Selector, all you need know is the characteristics that come with the job: type and condition of material to be worked, the number of pieces to be produced, the method of working, and the condition of the equipment to be used.

FOUR STEPS—and you've got the right answer!

1. Move arrow to major class covering application
2. Select sub-group which best fits application
3. Note major tool characteristics (under arrow) and other characteristics in cut-outs for each grade in sub-group
4. Select tool steel indicated

That's all there is to it!

Here's an example:

Application—Deep drawing die for steel

Major Class—Metal Forming—Cold

Sub-Group—Special Purpose

Tool Characteristics—Wear Resistance

Tool Steel—Airdi 150

One turn of the dial does it!

And you're sure you're right!!

Crucible Steel Company of America
Dept. A, Chrysler Building
New York 17, N. Y.

Gentlemen:

Sure! I want my CRUCIBLE TOOL STEEL SELECTOR!

Name _____ **Title** _____

Company _____

Street _____

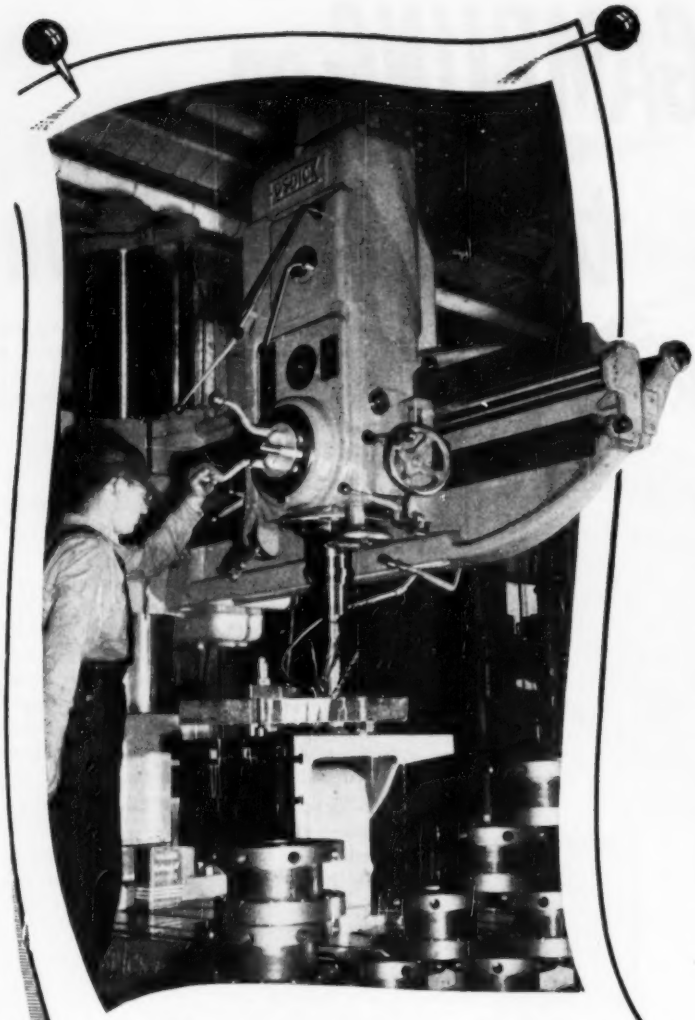
City _____ **State** _____

CRUCIBLE first name in special purpose steels

TOOL STEELS

fifty years of Fine *steelmaking*

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DENVER • DETROIT HOUSTON, TEXAS • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH • PROVIDENCE ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.



This picture tells its own story-

FOSDICK

HYDRAULIC

RADIAL•••

● Here is a typical shop scene of a FOSDICK Hydraulic RADIAL Drilling a hole in a steel piece.

On this machine the clamping of both head and column have been interlocked with the engaging of the feed mechanism. This hydraulic device operates from the conveniently located spindle feed clutch lever on the head. Saves operator time on set-up and locks head and arm instantly with throwing-in of feed clutch lever.

Another innovation is the fluorescent light located in a recess in the bottom of the arm which insures an even distribution of light over the work and at the point of contact of the drill, tap or reamer.

Another advantage is the tool ejector which automatically disengages the tool by moving spindle to extreme "up" position. Not only is this quicker than hunting for a hammer and drift to knock tool out but eliminates damage to tool shanks.

These are but a few of the many advantages offered in the new Fosdick Hydraulic Radial. *For complete details write for the Fosdick Hydraulic Radial Bulletin RDA.*

FOSDICK MACHINE TOOL *Company*

CINCINNATI 23, OHIO

Bay State Proudly Hails....

AMERICA'S NEWEST, FINEST, FASTEST, LUXURY LINER . . .

"Independence"

Launched June 3, 1950
Bethlehem Steel Co.
(Shipbuilding Division)
Quincy, Massachusetts
Maiden Voyage Feb., 1951

Courtesy American Export Lines · Inc.

BAYFLEX® abrasive products played an important part in the building of this super liner . . . removal of rust and scale from steel plates before fabrication . . . grinding and finishing of welds . . . cutting metal parts such as cabinet doors, angles, joints . . . grinding stainless steel sinks . . . and innumerable other metal grinding, cutting and finishing jobs.

BAYFLEX® abrasive products might be the answer to <u>your</u> grinding problems. Write us for a free demonstration.

BAY STATE®

BAY STATE ABRASIVE PRODUCTS CO.
Westboro, Massachusetts, U. S. A.
Chicago, Cleveland, Detroit, Pittsburgh
Distributors — Principal Cities

Top Performance Consistently Duplicated

TRAY-TOP CINTILATHES

EARN EXTRA DIVIDENDS

every working day...and here's why

They're ADAPTABLE

to a wide range of operations on hard or soft steels, cast irons, non-ferrous metals, with high speed or carbide tools. 12 speeds, all geared, in geometrical progression, 40 to 1 overall ratio. 48 thread and feed changes. Top speeds to 1800 rpm.

EFFICIENT

Simple, direct motor drive; minimum gear contacts; shaved gears; spindles mounted in large anti-friction bearings, effective lubrication throughout.

CONVENIENT

Centralized controls; instant selection of speeds with unique direct-reading "color-match" dial; dual control levers, easy-to-read thread chasing dial; graduated tail-stock barrel; "Tray-Tops" for convenient parking of tools, etc.

DURABLE

Anti-friction and oilite bearings, amply lubricated; integrally splined shafts and spindle of hardened alloy steel; Flamatic hardened gears in headstock, apron, and quick-change gear box; ground bedways, hardened if you specify.

SPACE SAVING

With two cabinet legs and "Tray-Tops" for parking tools, the ordinary storage cabinet becomes unnecessary.

SAFE

Control levers and snap levers disengage if something accidentally falls on them; long taper key drive spindle (chucks and face plates cannot spin off); electrical equipment fully enclosed; "Tray-Tops" keep wrenches, tools, gages off carriage wings and ways; cabinet legs store chucks and face plates away from operator's feet.

LOW COST

Tray-Tops are truly economical. For example, the 15" x 42" Toolroom Model, with taper attachment, flame hardened ways, two chucks, and regular equipment including 2 hp motor sells for only $2913.28, f.o.b. Cincinnati.

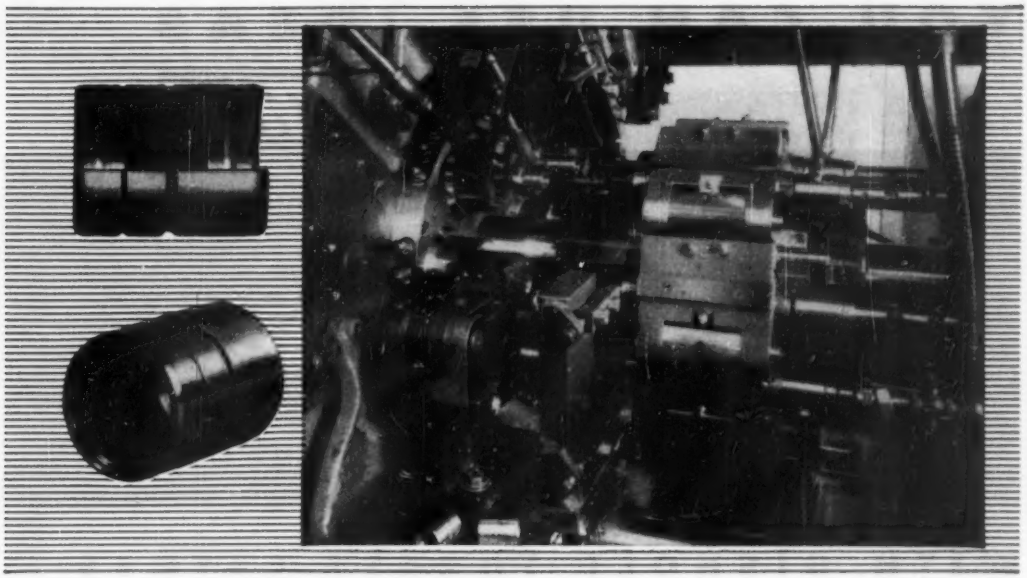
CINTILATHE

OF OUTSTANDING VALUE

. . . and because of their low first cost they do not "eat their heads off" in carrying charges the rest of the time. Size up all the economy-priced lathes and you'll agree that Tray-Tops deliver more work per dollar invested than any other lathes in their class. Make Tray-Top your **next buy** because it's your **best buy!**

CINCINNATI LATHE & TOOL CO.

Cincinnati 9, Ohio, U. S. A.



HIGH Production—300 Parts Per Hr. and WIDE Tooling Adaptability Mean HANDSOME Savings in Machining Costs

"*More good pieces in the pan per day*"—that's what you get with an Acme-Gridley Automatic Bar Machine.

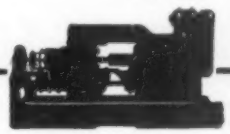
The reasons are inherent in the machine's basic design: positive, direct camming permits extremely accurate sustained production at high speeds. And broad, open tooling zones provide plenty of room for timesaving, money-saving independent-drive auxiliaries that combine cuts, reduce handling and machining times.

Typical of this versatility of tooling is the setup illustrated: four independently operated, internal recess-milling tools, two for roughing and two for finishing, are used, together with a shaving tool on the O.D.

Result? Very close concentricity, very satisfactory high production rate. May we show you how Acme-Gridleys can improve *your* production similarly?

JOB FACTS

Part—Bearing Cup
Material— SAE 52100 Steel Tubing
Operation— 10
Machine— 1¼" Acme-Gridley Bar Automatic
Machining Time— 12 Seconds Each (300/Hour)



Obsolescence is the creeping paralysis that strangles profit; the latest Acme-Gridley methods can breath new life into your production.

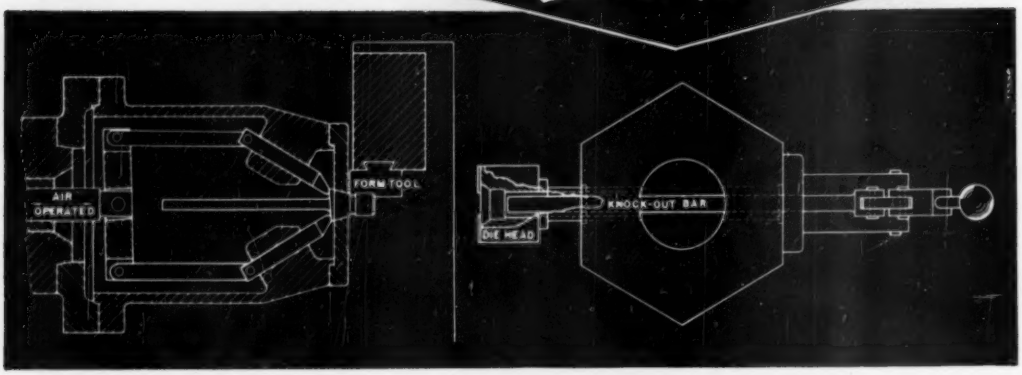
The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog-Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

YOU CAN USE IDEAS

Like This

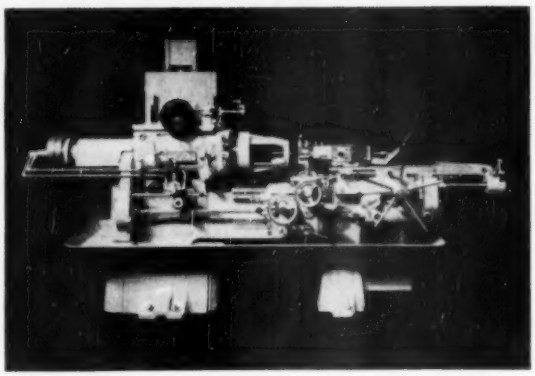


WITH GISHOLT TURRET LATHES

Here's a turbine blade job. It is a tough job to hold because not only are there a number of different blades, each of different length, but the work must be located and held against a tapered surface. It requires a special fixture. An air-operated plunger through the spindle forces the taper against the locating seat on the fixture, holding all sizes firmly.

The machining is done on the shank end. It must be turned and faced and necked for thread relief. Form tools on the rear of the cross slide handle all this in a single pass. Threading is done from the turret and a hand-operated knock-out bar loosens the blade from the fixture after the threading is completed. Production is more than adequate to meet the contract requirements.

This kind of investment pays off handsomely. If you are looking for practical, cost-cutting ideas, why not let Gisholt engineers help you. They have been specialists in turret lathe work for over 60 years.



Gisholt lathes are ideal for high speed work of this kind. With hydraulic spindle control, the Gisholt Speed Selector, and many other automatic features, operating time and effort are reduced to a minimum. Ask for literature.

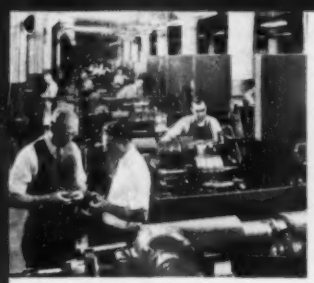
GISHOLT MACHINE COMPANY
MADISON 10, WISCONSIN

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

99 OUT OF 100 METALWORKING PLANTS

can save with these Gulf Quality Oils and Greases



GULF CUTTING OILS

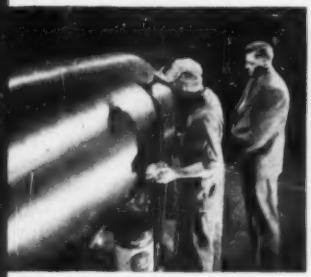
Gulf's complete line meets the requirements of every job in your shop. Let us demonstrate their superior performance.

GULF SUPER-QUENCH

A superior quenching oil which provides intensified dual action! Result: more uniform hardness, fewer rejects.

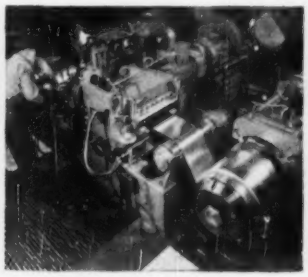
GULF HYDRAULIC OILS

The proper oil for every hydraulic metalworking machine—protection against rust, sludge, and excessive wear.



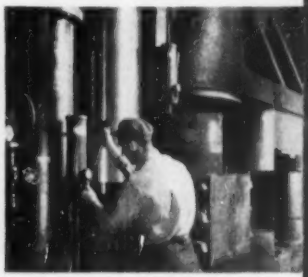
GULF RUST PREVENTIVES

Both oil and petrolatum types for every method of application, type of metal, condition of storage or shipment, and method of removal.



GULF METALWORKING OILS

Specially compounded oils for rolling, drawing, and forming operations on ferrous and nonferrous metals.



GULF LUBRICATING OILS AND GREASES

Insure maximum protection for every machine in your shop — with a minimum of different lubricants.

It will pay you to investigate their application in your plant.
Call in a Gulf Lubrication Engineer today.

Gulf Oil Corporation · Gulf Refining Company

GULF BUILDING, PITTSBURGH, PA.

Sales Offices - Warehouses
Located in principal cities and towns throughout
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GULF INDUSTRIAL LUBRICATION

Profitable Productive Ability with MEN and MACHINES...

BULLARD

A well known axiom "The whole is greater than any of its parts" leads us to consider—Men and Machines. Mult-Au-Matics are designed and built with a thought to the human operating element. Operators on every hand acclaim this viewpoint and produce accordingly. Therefore, with men and Mult-Au-Matics, Production Volume is only limited by the Ability of the Mult-Au-Matics themselves.

This Ability or Productive Capacity is definitely stated in Bullard Engineering Estimates on your work. We suggest that you take advantage of our Engineering Service with a view to making comparative studies. Reflect on your comparisons, and at the same time Reflect on—Men and Mult-Au-Matics—The Profitable Combination.

A Hard job done the Easy way on a Bullard Mult-Au-Matic

Mult-Au-Matics in Models and Sizes to meet your requirements

Type "D"—8", 12", 16"—6 or 8 Spindles

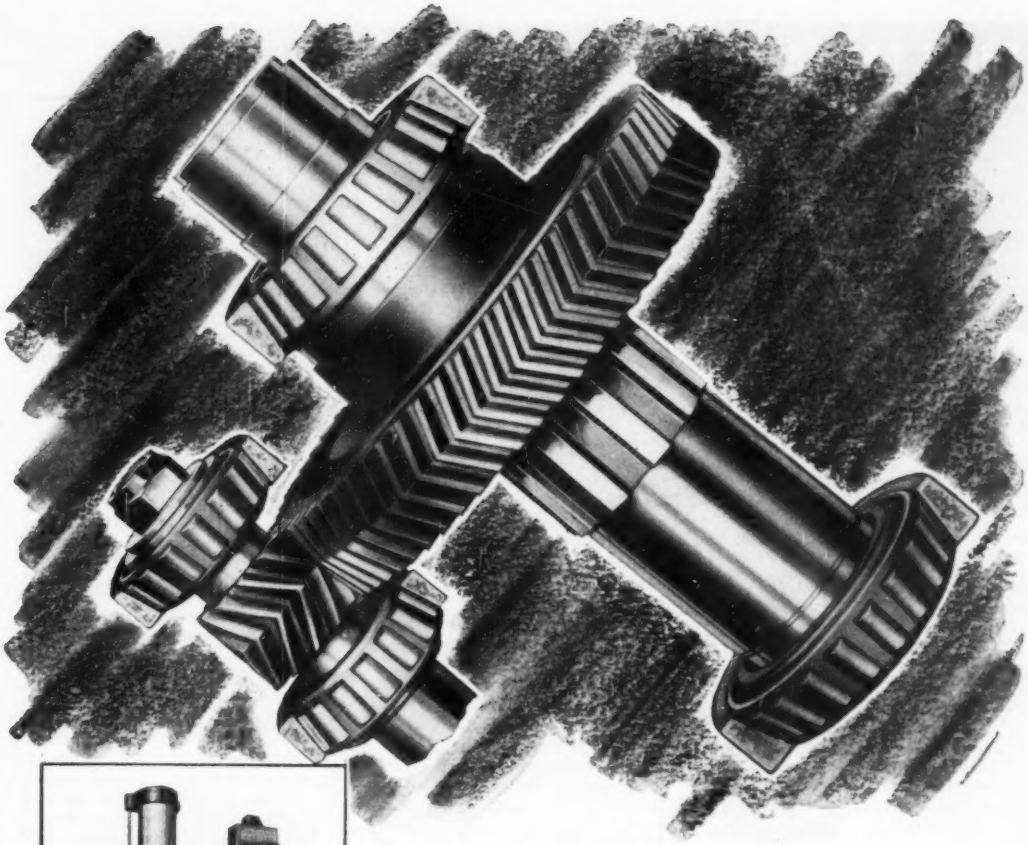
Type 16-23"—8 Spindles

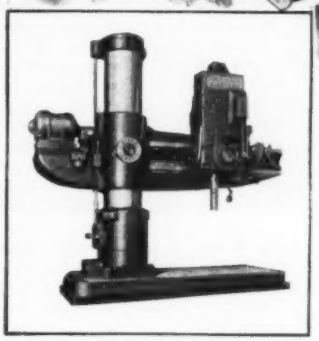
Type "K" 9½" to 10¾" Capacity 6, 8, 12 or 16 Spindles

Send us your work samples or blueprints for Engineering Estimates.

THE BULLARD COMPANY

BRIDGEPORT 2, CONNECTICUT





On EVERY JOB you do—

The smooth, chatterless, powerful and durable drive of the Cincinnati Bickford Super Service Radial Drill is a success factor in every job you do.

Driven by 10 splines machined from the solid, the driving gear is mounted on a special continuous bronze alloy sleeve which is carried by anti-friction bearings mounted on close centers.

Herringbone, continuous tooth gears are used for the lower speed ranges—for strength and smooth-rolling action.

The large continuous tooth gear never exceeds 500′ peripheral speed a minute, automatically declutches at high speeds and eliminates strains of flywheel inertia on high speeds and on spindle reverse.

Such design and engineering give Cincinnati Bickford Super Service Radial Drills great accuracy and a long life of trouble-free operation.

Write for the detailed bulletin No. R-29 for complete data.

THE CINCINNATI BICKFORD TOOL CO.

RADIAL AND UPRIGHT DRILLING MACHINES

SUPER SERVICE

Radials 7½" dia. col., 21½" arm, to 96" dia. col., 12' arm.
General purpose Uprights 21" to 28" sizes.
Production Uprights 21" to 28".
Jig Borers, Portable Horizontals, Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

CROSS UNIVERSAL GEAR MACHINES

for

- ROUNDING
- CHAMFERING
- POINTING
- BURRING

Cross Universal Gear Machines embody advanced engineering developments to obtain highest productivity and assure lowest possible operating costs.

They feature utmost flexibility for handling a wide variety of gears. Continuous cutting motion, exclusive with Cross, speeds production at top efficiency.

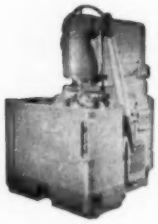
Special skill is not required because machines are automatic and push button controlled. Power clamping is foot pedal controlled. Both hands are free for work handling.

No. 55

For rounding, pointing, chamfering or burring external and internal:

spur gears
helical gears
clutches
splines

Typical productivity when rounding or pointing 8 pitch 30 tooth gears is 55 net hourly.



No. 65

For pointing or chamfering external and internal:

clutches
spur gears
bevel gears
splines

Typical productivity when pointing 10 pitch 30 tooth gears is 100 net hourly.

No. 75

For burring or chamfering both ends at the same time.

helical gears
spiral bevel pinions
hypoid pinions

Typical productivity when chamfering 8 pitch 40 tooth gears is 200 net hourly.

THE CROSS COMPANY
Established 1898

SPECIAL MACHINE TOOLS
MILLING • DRILLING • TAPPING • BORING
TURNING • SHAPING • GRINDING • HONING

DETROIT 7, MICHIGAN

BACKLASH

Wrench Wrangle

You have two illustrations which purport to show the proper direction of pull in relation to position for Crescent-type adjustable wrenches. With the wrench used as you indicate (page 85, *AM, May* 29), the tip of the weaker, or adjustable, wrench face is the heavily loaded tip. If it is used in the manner you indicate as undesirable, then the heavy tip loading is on the strong stationary tip.

Just what use your "Know Your Hand Tools" pages could be to anyone far enough advanced to be interested in *American Machinist* is a little unclear to me.

Robert R. Hull, Engineer
Pasadena, Calif.

Mr. Hull is wrong; your article is correct. We are constantly testing our wrenches, and tests have consistently shown that, when used in reverse, wrenches break at 25 to 30% less than the strength given when used properly. The name "Crescent" should not be used except when applied to wrenches made by Crescent Tool Co., Jamestown, NY.

We take exception to Mr. Hull's statement that the article is out of place in a magazine for advanced readers. In our opinion, an article on the proper use and care of tools is appropriate in any magazine, no matter how advanced its readers.

If Mr. Hull is still unconvinced, our engineers will be very glad to discuss the matter with him further.

Argus Sheridan
Crescent Tool Co.

Is this report to be reprinted for distribution? I should like to have half a dozen copies for selected men in our Schools of Mechanical Engineering and Shop Practice.

This article is something that has needed to be done for a long time. I congratulate you on not only the thoroughness but the practicality of the instruction in it.

Robert B. Keller
Director Educational Research
International Correspondence Schools

We noticed a splendid article entitled "Know Your Hand Tools." We are wondering if it would be possible to obtain 50 reprints for our employees. We have been looking for an article of this type for a long time and we know that the workers in our plant would benefit very much from it.

P. N. Wheeler
Unisorb Division
The Felters Company

Girl Toolmaker Kneaded

I was much interested in the article by T. G. Falstrom on kneading type faces (*AM*, page 85, June 12). It recalled a visit to a little shop in Trenton, N. J., about 1920. The boss was a slightly built mechanic of Irish descent, and his husky daughter was his toolmaker. This was a real novelty at the time—and she was a good toolmaker, judging by the tools I saw and the work she was doing.

The little shop was making type for either typewriter or adding-machine people, I'm not sure which. But they were kneading the metal to coax it up into the dies, and succeeding very well indeed. I wrote the story for the *American Machinist*.

Perhaps my favorite reminiscence dates back to about 1895 when I was visiting Amos Brainard in his Hyde Park, Mass., shop where he built conventional milling machines. That was the first time I had ever heard of "climb" milling, although I don't think he called it by that name. He had designed a compensating nut to prevent backlash and had it patented. Years afterward, W. D. O'Connor of the Kearney & Trecker sent me the date of the patent. It was No. 131,733, issued Oct. 1, 1872, believe it or not.

There are many other cases where ideas lie fallow for years. The first gas car I ever rode in had the gear-shift lever up under the steering lever, and Pierce-Arrow used it for about three years beginning in 1902. We "rediscovered" it a comparatively few years ago.

Fred Colvin
Point Pleasant, N. J.

SALES ENGINEERS

for Hanna Cylinders, Valves

AT YOUR SERVICE ACROSS THE NATION

There is a Hanna representative near you, ready to bring you his experience in making the most practical application of Hanna equipment to your particular problem.

Fifty years' experience in manufacture and application of Air Cylinders, Hydraulic Cylinders and Air Valves are back of these representatives. It's an experience available to you without obligation. The thousands of satisfied Hanna customers are evidence not only of our quality products but also of the efficient service of our representatives.

Hanna Engineering Works

HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

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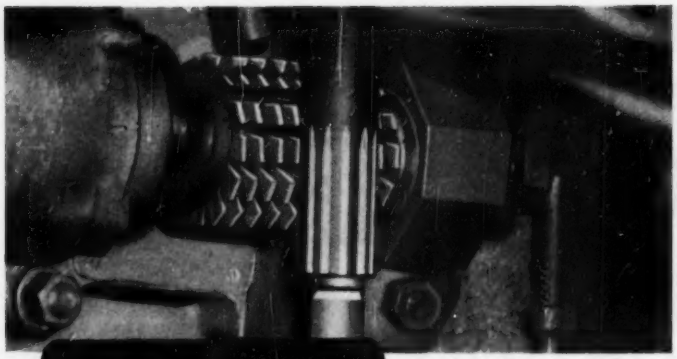
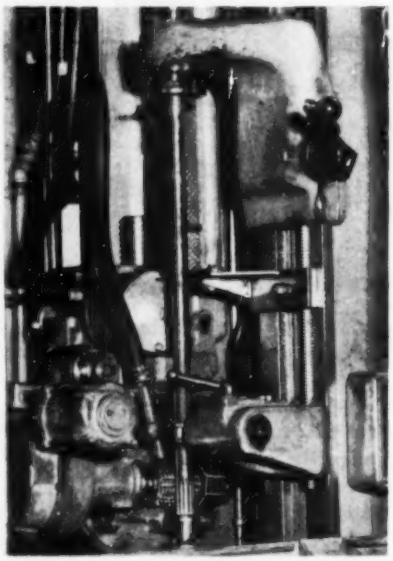


CLIMB-CUTTING
IMPROVED AND SIMPLIFIED 3 WAYS!

Point Drivers developed by Lees-Bradner provide important advantages in hobbing splines on axle shafts, etc., and are available on all Lees-Bradner Hobbing Machines.

POINT DRIVERS

TAILSTOCK brings down the part (mounted between centers) . . . point drivers bite into part . . . clamp the tailstock and climb-cut the spline with the thrust of the cut down.



1 Permits climb-cutting . . . always a big advantage on steels such as used for axle shafts.

2 Tooling is simplicity itself . . . no loose pieces, chucks, etc., to handle . . . speedier and easier loading and unloading assures increased hourly production.

3 Cut is taken right down at nose of spindle, the downward thrust driving the part down more firmly instead of tending to lift the part off the driver.

For detailed information, call your Lees-Bradner representative.

The LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

Our Slip Is Showing

On Page 2 of *AM* for May 29 for 1950, it states that the operation pictured on the cover is done on a "semi-automatic milling machine." This is not semi-automatic milling but an entirely automatic milling operation on a Newark Automatic Spur Gear Cutter. Milling slots is only one of the operations the cutter is capable of performing. Cutting the pictured slots and similar operations cannot be done by hobbing or shaping. Of course, milling of the slots could be done on a very large milling machine, but this would be a hand-indexed operation and not at all automatic.

William F. Hoffmann
President, Newark (N.J.) Gear, Inc.

Where Are the Toolmakers?

Reading through John R. Godfrey's mournful diatribe on this subject leads me to think that Mr. Godfrey had been very unfortunate in his choice of plants. My own experience, covering 36 years of toolroom supervision here in England, has been one of ever-continuing progress. Perhaps it was because, whilst still in my teens, I chose shops noted the world over for the interchangeable products which flow from them. These were the Maxim Gun Company, next the Royal Small Arms Factory at Enfield. This latter was, as you no doubt know, built by Robbins and Lawrence of Springfield, Vt., and in the first place equipped with American machine tools. And what tools they were! Many were by The Ames Manufacturing Company, Chicopee, Mass.

I got my first toolroom foreman's position with the Thames Engineering & Shipbuilding Company in 1910. At this plant I found many excellent toolmakers (although they called them "tool-fitters"), but all those men turned out fine jigs and gages with the most primitive tools. I then took over with a famous passenger-transport concern. Here I found 50% of the men were first class, and the others were content to do the rough stuff, so things ran smoothly.

"Youth and old age cannot live together" seems to be proved by Mr. Godfrey.

James Pearman
Hove, England

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

Life-Linestarter*

Only one moving element — a seesaw balanced on a knife-edge

No complex linkages in the contact closing mechanism of the new Westinghouse Life-Linestarter, which is years ahead in its principle of operation. No sliding surfaces to bend. No lubrication needed. Nothing to stick or jam. The new principle, backed by 40 years of experience and perfected by more than 6 years of laboratory and field tests, opens the way to fewer outages, increased production, lower operating costs.

Compare this operating principle with that of other starters. Compare, too, for positive protection—compare the positive kickout spring which provides the force needed to open the contacts—for rapid, uniform action, independent of gravity. Also compare Life-Linestarter for uniformity and completeness of line, NEMA sizes 0 through 4, ease of installation and other key advantages.

Get the facts. Your local Westinghouse representative is ready to show you "the inside story" by Trans-Vision. Or write for 20-page booklet B-4677. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Penna. J-30021

*Trade Mark

Westinghouse

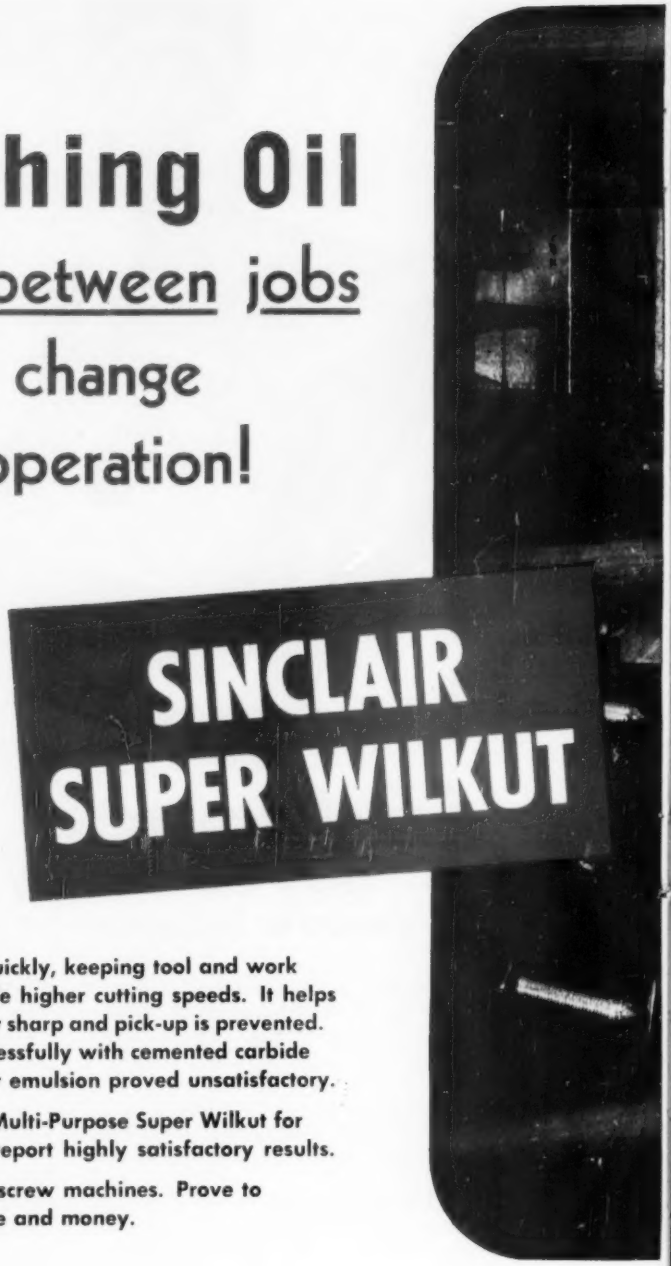
Life-Linestarter

TOMORROW'S STARTER—TODAY!

No Switching Oil

on automatics between jobs

...regardless of change of metal or operation!



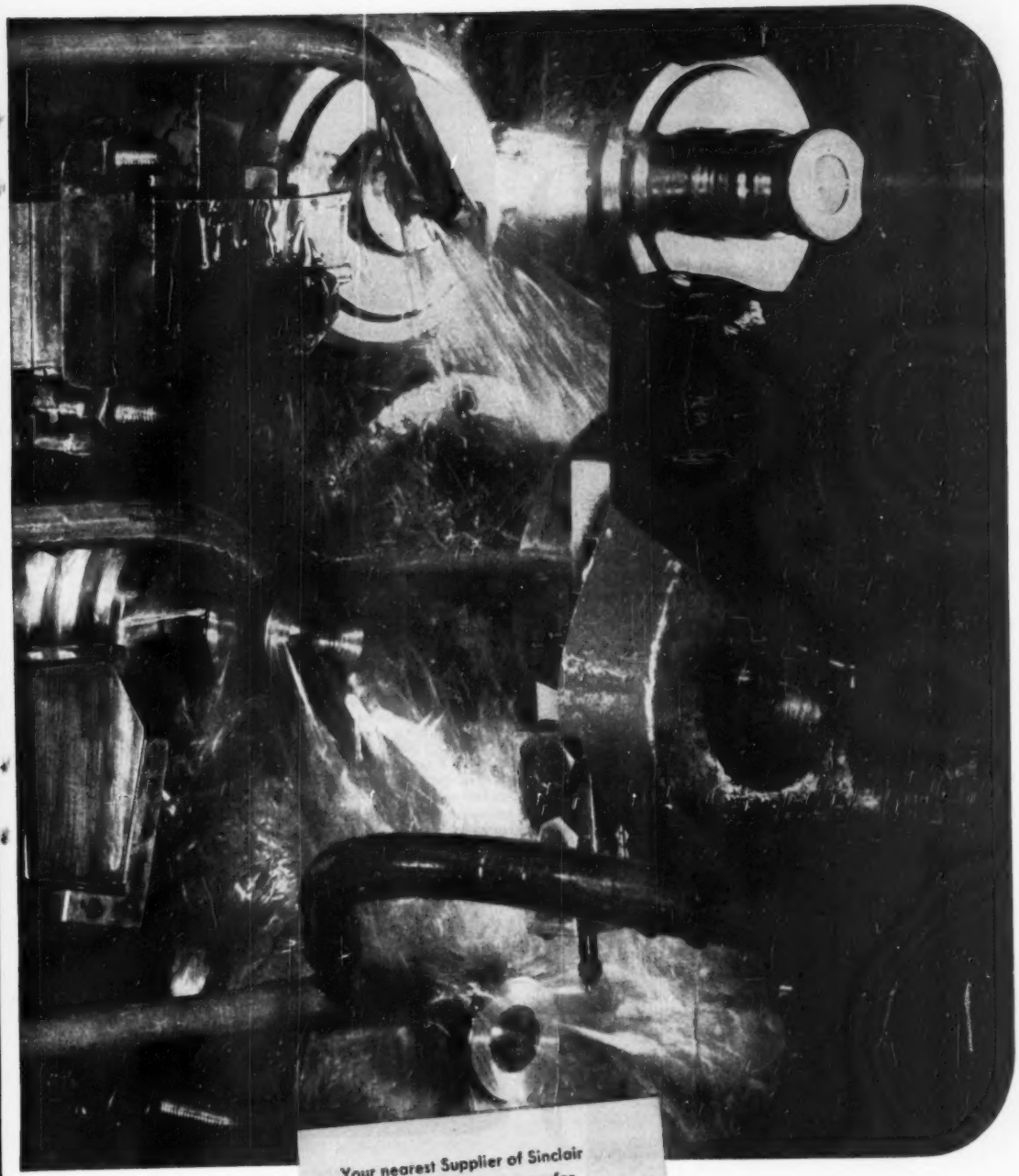
You don't have to change oil every time the metal on the job is changed! Here's a sulphurized cutting oil that can be used effectively on any metal—ferrous and non-ferrous, including difficult alloys. And it can be used on any type of screw machine.

Sinclair Super Wilkut, besides being versatile, is also highly efficient. It carries heat away quickly, keeping tool and work cooler—often making practicable higher cutting speeds. It helps produce accurate finish; tools stay sharp and pick-up is prevented. Super Wilqut has been used successfully with cemented carbide tools where recommended water emulsion proved unsatisfactory.

Note: **Many operators even use Multi-Purpose Super Wilkut for lubricating their machines and report highly satisfactory results.**

Try Super Wilkut in one of your screw machines. Prove to yourself that it can save you time and money.

SINCLAIR INDUSTRIAL



Your nearest Supplier of Sinclair Products will gladly arrange for lubrication counsel, or write to Sinclair Refining Company, 630 Fifth Avenue, New York 20, N. Y.

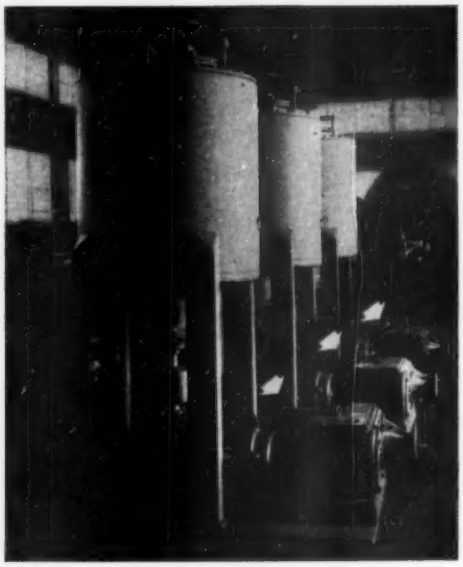
OILS

Example: Compensate for changes in material consistency

For your agitators, churns or other processing machines handling materials which change in consistency, density or viscosity, accurate, positive, infinitely variable REEVES Speed Control is a *must.*

Providing machine speeds which can be increased or decreased to the fraction of an rpm as the product thins or thickens, REEVES Speed Control assures continuous operation—without shut-downs or slow-downs for changing speeds—at the fastest possible pace. Rate of production goes up . . . quality is improved and always uniform . . . cost goes down.

REEVES Variable Speed Drives are easily and economically applied to machines already in service . . . are standard equipment on more than 2,100 different makes of new machines. Investigate REEVES right away. Choose from the most complete line of speed control equipment available *anywhere* . . . your assurance of obtaining the units that are *exactly* right for your particular machines and your particular speed control problem. Write for *free* copy of comprehensive, 132-page catalog A47-3N.



Churns for rubber cement: Illustrated here is a typical application wherein REEVES Speed Control is used to compensate for changes in consistency, density and viscosity. Each of these three churns is standardly equipped with a REEVES Vari-Speed Motodrive, as shown in right foreground. At the beginning of the batch, the agitator paddle turns at its fastest rate of speed. As more rubber is admitted to the churn, mixing with the liquid vehicle, the solution becomes thicker and the speed of the churn must be decreased until the final maximum density of the solution has been obtained. Use of the REEVES Motodrive permits the churn to be operated at high speed while the solution is thin, thus accomplishing a higher rate of production than if paddle had turned at a slow, fixed speed, as determined by the maximum density of the mixture. With variable speed, therefore, the operating speed of the churn is not dependent upon the minimum, but upon the maximum speed for the changing density. For other production-increasing, cost-cutting functions which can best be performed by REEVES Speed Control, see the listing below.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

Recognized Leader in the Specialized Field of Speed Control Engineering

accurate • variable
REEVES *Speed Control*

Other Uses:

Handle more shapes, sizes and materials • Match skills of operators • Assure accurate timing • Maintain uniform peripheral speeds • Maintain uniform pressure, temperature, liquid level, etc. • Regulate conveyor speeds • Synchronize parts of one machine or different machines operating in series.

SPOT NEWS of Metalworking

- **Don't go to Washington to get defense contracts.** Instead, contact field procurement office of Army, Navy or Air Force in your district (there are 55 such offices around the country). But before you go, get together basic information on: 1) what you can make, 2) breakdown of tools and facilities, 3) manpower available, 4) productive capacity, 5) financial standing. For detailed story, see page 134.

- **Defense Department figures it will be lucky to spend as much as $2.5 billion** by next June 30 of the $6.2 billion asked for in war-goods procurement. It will take that long to work up specific requirements, let contracts and convert production lines (see Washington, page 73).

- **Aluminum rolling process for producing tapered-section airplane wing sheets** has been developed by leading manufacturer. It will greatly reduce milling operations now needed to finish these sheets. New process is difficult and expensive, according to reports.

Strike control program to avoid interruption of defense production is in development stage. Work is being done by National Security Resources Board, but administration likely will be by board representing employers, labor and public. Labor Department would like to be in charge.

- **New 10-hp automobile to sell at $1,100 is to be made in Australia** by Reville Motors Pty. Ltd., Brisbane, Queensland. Features: self-change gear box, fluid drive, 40 miles to gallon, carburetor installed high enough to enable car to drive through 2 ft. of water. Daimler, Ltd., British auto maker, will supply engines, but other components will be made in Australia.

- **Liberalized depreciation allowances on new equipment** may be substituted for World War II's five-year amortization plan as stimulus to expansion of facilities for war production purposes. At least Washington officials are toying with the idea.

- **Machine tools and other equipment for tank plant of Cadillac Division** of General Motors at Cleveland will be supplied largely from JANMAT reserves of government, Cleveland reports state. Plant has been under lease as warehouse to National Terminals Corp. E. N. Cole, who did tank engineering for Cadillac in last war, will be operating head.

- **Boeing is expected to get some $400 million of aircraft orders** because of its large pool of skilled workers at Seattle (where it now employs 18,000). Seattle and nearby Renton plants have been making parts for nearly 100 B-47s, as well as producing B-50s.

Large number of U.S. machine tools for RIV (Officine Villar Perosa) at Turin, Italy, is being held up by refusal of Washington to grant export licenses. Same is true of $12 million of U.S. steel rolling mill machinery destined for Austria. Reasons: RIV has been exporting bearings to Soviet satellites, and Austria is too close to Russia for comfort.

- **Some 90% of contracts let with extra $10.5 billion** for war production will be negotiated partly because they can be awarded faster than on advertised-bid basis. All negotiated defense contracts this fiscal year will be subject to same renegotiation rules as in 1950.

- **Heaviest pressure for fast delivery of war goods** will be for tanks, guns, electronic devices, vehicles and the like. These are things being expended in Korean fighting. $2.64 billion have been asked for these items. New orders for aircraft rockets and other propellants have gone out already.

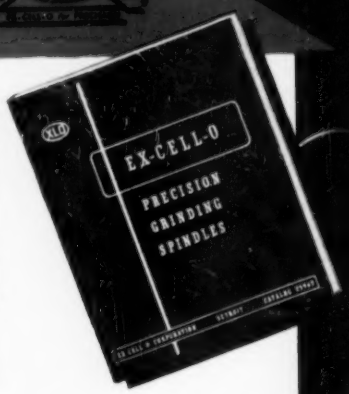
- **Powerful new turbojet aircraft engine,** completely American in design, has been built and successfully flown by Pratt & Whitney Aircraft. Known as the J-57, it is of axial flow design and is built to produce 7500 lb. of thrust. In addition, Pratt & Whitney is working on a turboprop engine designated as PT-2.

PRECISION GRINDING ELIMINATES SCRAPING

Ex-Cell-O Spindle Finishes Dovetail Ways in 1/10 the Time Formerly Required

Actual case histories show that slide ways now being precision ground in 15 minutes formerly required 2½ to 3 hours of hand scraping to obtain satisfactory bearing. Slightly larger slides that are now precision ground in 20 minutes formerly required 3 to 4 hours of hand scraping.

Ex-Cell-O spindle engineers have a wealth of experience in designing precision spindles to meet special applications. If you don't find a spindle to suit your needs in the spindle catalog, write to Ex-Cell-O stating the operation to be performed and your requirements in terms of speed, horsepower and preferred driving method. A simple sketch showing some basic dimensions is helpful, too.



If you would like an Ex-Cell-O Precision Grinding Spindle Catalog without obligation, just write on your company letterhead, asking for Catalog Number 25962.

30-22

EX-CELL-O CORPORATION DETROIT 32 MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS
DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Washington

Biggest chunk of President Truman's $10.5-billion new money request will go for aircraft — $3,344.6-million for Air Force, Navy, and Marine Corps. Air Force gets $2,777-million of that.

It means another 3,000 planes will be ordered in addition to the 2,300 already planned before Korea.

Three is the maximum annual expansion factor of the aircraft industry. It means that the present monthly rate of 215 military planes of all types new being built could be tripled to 645 by next July. The speed-up won't be that great.

Biggest emphasis will be on building up the Strategic Air Command with more big bombers like Consolidated's B-36, Boeing's B-47 Stratojet.

Right now not one SAC group is operating full strength. Most of them are still flying World War II B-29's instead of newer B-50's and bigger B-36's.

Demand will be heavy for tactical aircraft for close-in ground troop support. Korea is proving we still need them — even in an atomic age.

Also look for faster buying of combat cargo carriers for equipping new fast-striking airborne divisions.

• • •

Defense Department buyers figure they'll be lucky if they are able to spend as much as $2.5-billion by next June 30 of the $6.2-billion they've asked for in new military hard goods procurement.

It means that of the total $10.5-billion asked for partial mobilization, only about $6.5-billion will actually be paid out this year.

It takes that long to work up specific requirements, let contracts, and convert production lines.

Most of the money will be committed by then, but payments are tied to deliveries, which will extend over two or three years more. Exception is on heavy procurement like ships where progress payments are made from time-to-time.

It isn't necessary, even, to let contracts this fiscal year for planes, ships, and construction. These are "no year" dollars — can be committed any time.

Money for tanks, guns, vehicles, ammunition, however, must be committed before the end of the fiscal year, or services lose right to it.

• • •

For naval ships Truman has asked $185-million. Most of this will go for submarines to "kill" other submarines and for reactivation of laid-up ships.

Also, don't be surprised if the super-liner, SS United States, slides down the ways a super aircraft carrier. Navy's still got months to decide.

Note this, as well: The keel of the original super-carrier, "sunk" by Defense Secretary Johnson, is still intact. Given the money, work could be resumed at any time.

• • •

Truman's request for $5-billion more in taxes is only a starter, but it will go a long way towards paying for actual disbursements this year.

It will be next spring before administration budgeteers have a sure idea of what tax increases it will take to pay for extra defense costs.

• • •

You'll lose few skilled workers to the draft which now, at least, is taking only non-vets under 26. But you can lose skilled workers to reserve calls.

Draft deferments are available for men "necessary" in the national interest. There is still no group deferment policy based on occupation. Each individual case is handled separately through local draft boards.

There's still no deferment policy for reservists, but one is expected shortly. Sometimes it is possible to get a delay in orders by special appeal to the nearest reserve headquarters.

• • •

Wage trend is upward. Unions are afraid future government action might freeze them out of a pay increase.

It's taking the pressure off pensions somewhat. But the threat of inflation means more unions want a cost-of-living escalator like the General Motors formula.

Some unions are accepting modest wage increases now with a promise of more next year.

• • •

Allocation of steel, copper, and aluminum may be all that's needed in this half-war state. It will give you indirect — but effective — end-use control over chrome, vanadium, manganese, tin, cobalt, molybdenum, zinc, tungsten, nickel, other important alloying agents.

Increased demands for aluminum may force rationing of electric power to industry. It's what limits ingot production. But that will come later rather than now.

If U. S. troops get pushed out of Korea, Defense Secretary Johnson is finished for sure. He's on shaky ground already, and may be eased out gracefully in the next few months even if we hold the Pusan line. Present Army Secretary Frank Pace would probably get his job.

Pressure for replacing Secretary of State Acheson isn't as great. Neither are the reasons. Current reports of unrest in Red China lend weight to his theories. Besides there's no likely successor to the job.

AUTOMATIC
GAGE
RING
MICROSIZE*
—holes tolerance
of .0003" or less,
on diameter
Hydrohoner equipped with automatic MICRO-SIZE control Microhoning small-diameter holes in long parts.
Double-Spindle Hydrohoner shown Microhoning large-diameter, short bore. Electronic-MICRO-SIZE control is interlocked with automatic indexing table to give automatic operation.

INCREASED PRODUCTION

FROM MORE ACCURATE, MORE CONSISTENT CONTROL OF SIZE . . .

MICROSIZE—AUTOMATIC SIZE CONTROL adaptable to bores of any diameter or length. Electronic control automatically stops operation when bore is Microhoned to desired size. Tool feed-out is adjusted automatically.

Reduces:
HANDLING
INSPECTION
SCRAP
SELECTIVE FITS
RE-RUNS

AUTOMATIC GAGE BAR MICROSIZE . .
holes tolerance of .0007" or less on diameter.
Cow Hitch
MICROSIZE heads on V-type machine. All 8-cylinders in block are Microhoned simultaneously.
Double-Spindle machine Microhoning hard, thin-wall cylinder liners.

*Registered U.S. Patent Office

Micromatic Hone Corporation 8100 SCHOOLCRAFT AVENUE DETROIT 4, MICHIGAN

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55 George St., Brantford, Ontario, Canada • Micromold Manufacturing Div., Boston Post Road, Guilford, Connecticut

Detroit

Echoes of December 1941—that's the sound of things at Detroit. The entire picture is taking shape in parallel to those frenzied days following Pearl Harbor. Here are some of the attributes—

War orders: Cadillac is closing a major contract with ordnance for medium, 28-ton tanks of a new type. Manufacturing will be outside the state; the wartime Fisher bomber plant at the edge of Cleveland's airport is being considered.

• • •

Auto curtailment: It hasn't come yet, but C. E. Wilson, GM president, remarked in connection with the Cadillac tank job that the extent of war goods ordering would determine materials availability, and that in turn would call the tune on production. Meanwhile steel is in shorter and shorter supply.

• • •

Tooling: The tool shops are busy and will be busier. On top of their civilian load, they expect to be getting releases on such jobs as the Cadillac tank program, others.

Labor: Walter Reuther, president of the CIO Auto Workers, paralleled his position of 1941-42 when he called for joint conferences with presidents of auto companies to take a common position on production, manpower disposition, conversion plans, et al.

Facilities pooling: It's already begun, with Reo furnishing engines, sheet metal and other parts for which it has ample facilities to Studebaker. Both companies are building 2½-ton 6x6 trucks.

Manpower availability: Detroit is on the edge of its manpower pool; any substantial armament commitments will result in shortages. June saw payrolls at a peacetime peak; July was higher. Upcoming shortages would be true not alone for rank-and-file and skilled help, but for executive talent as well. Any doubling in brass, combining guns and butter output, will tighten up the supply of executive personnel.

• • •

A war, that's half-hot, half-cold will mean plenty, plenty tooling. The reason: In a period when the civilian economy is being only half-converted, the military will make a definite effort to standardize on both designs and manufacturing sources.

The meaning: One company will, so far as possible, produce all requirements of one type, and will do it by multiple plant operations. Thus, a manufacturer of tanks of one type—or engines of one type—or aircraft of one type—and so on—will tool more than one plant to do the job. Locales will be in different parts of the country. Thus, large complements of equipment will be required. From one standpoint, the meaning is that even in a period of half-cold, half-hot war, tooling will be on a broad basis almost disproportionate with the output programmed. That's a military approach to full preparedness for any eventuality.

• • •

Auto sales continue strictly terrific. New records are being set all over the landscape. What was a fat month's inventory of cars in the field at the start of July had dwindled by month's end to less than a fortnight's. By mid-August the field float is expected to be down to cars in transit from factories to dealers.

• • •

Production, meanwhile, is at the limit of incoming supplies. During the third quarter the industry as a whole was figuring on building around 2,400,000 cars and trucks, U. S. and Canadian combined. That provided for about 900,000 in July, 800,000 in August, 700,000 in September. Day-to-day plans at this writing are to maintain that projection—shortened steel supplies may cut back the actual August total, but in view of the intense field demand the full seasonal tapering of September wouldn't come to pass. BUT, and this is a big but—allocations may come along any day and shoot those forward schedules higher than a flying saucer.

• • •

Production jottings: Willys is enlarging jeep and engine production; it has set up second shifts in many motor parts departments. Nash seems about decided to go ahead on its NXI experimental car, but not till the time's ripe; development has been brought to the point of releasing tooling.

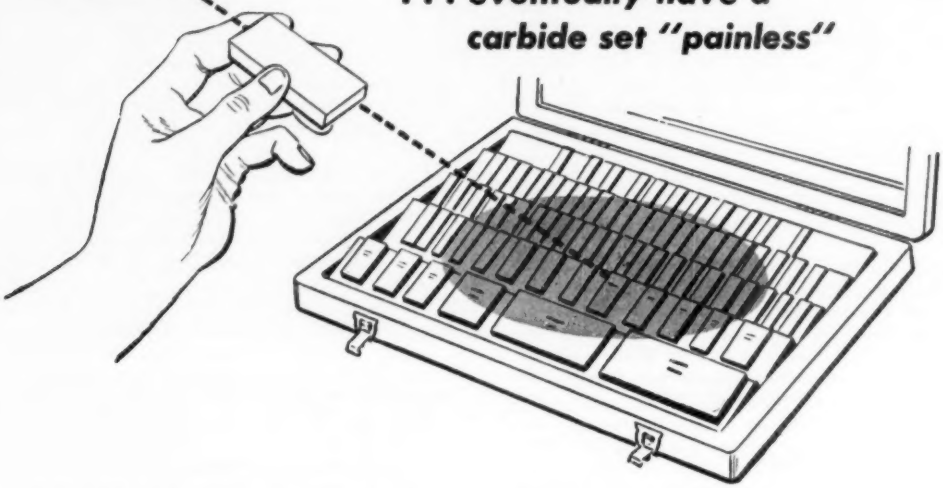
H. C. Kellogg

Henry Rourke

H. C. Kellogg, Ford Motor Company's director of purchasing engineering, has retired. **Henry Rourke,** former assistant director, assumes Mr. Kellogg's duties in the newly created post of general purchasing agent, purchasing engineering and will report to **I. A. Duffy,** v.p.-purchasing.

Replace worn blocks with CARBIDE

. . . eventually have a carbide set "painless"



A few blocks in every set are in constant use. They wear faster and are replaced at a faster rate than other blocks of the same set.

Replace them now with carbide Carblox and follow that policy on future replacements and your present set will be eventually converted to long-wearing carbide.

Here's the "painless" method to acquire Carblox, the blocks that outwear steel many times. No need for a special appropriation or a board session to approve the expenditure. Send your suspected blocks to us now with instructions to replace them. Or send us the entire set for inspection and recalibration. The prices of individual Carblox have been lowered substantially to make cost of such conversion easier to absorb.

THE WEBBER GAGE COMPANY
12901 Triskett Road • Cleveland 11, Ohio

No More Accurate Block Available Anywhere . . .

Examinations in customers plants who have facilities for detecting errors in millionths of an inch, have repeatedly demonstrated that no more accurate block is available anywhere. On the average, the actual dimensions showed a fraction of the tolerance that Webber specifications allow in manufacture.

INSPECTION AND RECALIBRATION OF 84-BLOCK SET

Submit sets for periodic inspection to determine degree of wear. Sets will be returned with a Certificate of Inspection showing actual dimensions of each block and recommendations for replacement of those blocks worn beyond reasonable limits.

$15

NEW LOWER PRICES ON INDIVIDUAL CARBLOX

A growing volume of carbide replacement business has enabled Webber to effect economies in production of individual blocks which are being passed on to the user. If you do not have the June 1st price supplement on Carblox, write for your copy. Note: This new price reduction does not apply to the complete set—only to individual carbide blocks.

Webber
MICRO-ACCURATE GAGE BLOCKS and FIXTURES

Standard Steel Blocks
Carblox Carbide Blocks
Angle Blocks
Heavy-Duty Blocks, Fixtures
Special Size Blocks

New Tooling

Many machine tool builders were swamped by a deluge of orders the latter half of July. Within two weeks or less, one maker of standard machines booked enough business to increase delivery dates from a few weeks to five months.

Another company, which quoted six-weeks' delivery the middle of July, is now up to 20 weeks. Many builders of "specials" have backlogs of one year or more.

• • •

This sudden uplift in sales put July far above the previous postwar peak attained in June—126.2 on the index of National Machine Tool Builders' Association. (See chart, p 80.)

What's more, it relieves anxiety in many places that the nation might come up to time of full war mobilization with a puny machine tool industry. Orders just placed make unnecessary the use of phantom orders to "spark" machine tool operations. A healthy expansion is assured at once.

• • •

Machine tool orders have come from all directions and sources. Reasons are: (1) to get machines before prices might go up, and (2) to secure deliveries before war priorities might be invoked.

There has been little buying at random. Most of orders have been closed on deals which builders' and distributors' salesmen have been quoting on for some time.

No war orders are represented in today's pile-up of business. None is expected for 30 to 60 days. Meanwhile, builders are scrambling for more manpower of all kinds—draftsmen, engineers, skilled operators. A big manpower training problem is ahead, complicated by the draft and calling of reserve officers.

• • •

Automotive orders still are in the forefront of recent bookings. Chrysler and Ford in particular have been heavy purchasers.

Ford has announced program of modernization and rehabilitation of pressed steel operations at Rouge plant to be completed by 1952. Major improvements will include installation of much new equipment.

• • •

An electrical goods manufacturer is spending $2.5 million on machine tools and other production equipment to revamp an existing plant for production of gas turbine units.

• • •

Western Europe is not likely to be pushed aside as outlet for U. S. machine tools, except as requirements for domestic military production interfere. Some $67 million of U. S. machines will be imported into ECA countries the current fiscal year, about one-third of it through private financing.

ECA allotments for U. S. machines in 1951 fiscal year break down like this: France $17 million; England $16 million; Italy $15 million; Netherlands $4.5; Austria $3.5; Belgium, Germany and Sweden $3 each; and Turkey $1.5.

U. S. machine tools bought with ECA funds ran to $128 million from April, 1948, to July, 1950. About $56 million were bought in fiscal year ended last June 30. Almost $20 million more were financed privately.

• • •

German manufacturers of metal products deplore the fact they cannot buy more U. S. machines. But they cannot raise enough Deutsch-marks to use up ECA financing made available to them. Sad story: in fiscal 1949, only $2.6 million of $4.3 million allocated by ECA to western Germany were taken up. Things were better in fiscal 1950. At end of May $2.7 million of possible $3.4 million had been utilized.

• • •

Don't overlook business to come out of western Europe as result of Mutual Defense Assistance Pact. About $85 million was to be spent for equipment for "Additional Military Production" (AMP), $35 million of it for machine tools in fiscal year just closed.

Much of that sum has not yet been contracted for. In addition, $75 million are going for AMP equipment the current fiscal year. A lot of it will be for machine tools. Purpose: to tool western European plants to make war goods.

• • •

Some $100 million will be spent in current fiscal year by ECA to finance importation into western Europe of metalworking machinery other than machine tools. Substantial portion will be for steel rolling mill machinery.

• • •

Quick acceleration of the defense budget is indicated in the $4-billion in letters of intent to buy aircraft sent out to over 200 companies. The action commits funds the Defense Department hasn't got yet, the 1951 regular appropriation plus $10.5 billion in supplemental funds.

Contracts will be let as soon as Congress appropriates the money. Phantom orders for machine tools aren't involved. Some Defense Department reserve tools will be sent to industry to speed production-line conversion.

Another NEW SUNDSTRAND RIGIDMIL

Model 55 With Mechanical Feed Available in Simplex, Duplex or Triplex Types

You'll find the right size and type of milling machine for your work in Sundstrand's complete line. For instance, the Model 55 Rigidmil illustrated has spindle motors ranging from 25 to 50 horsepower. Like most all standard Rigidmils, it can be provided in simplex, duplex or triplex types. Further versatility can be provided through the application of special heads, vertical feed to heads, second rate of feed, special heads, automatic index base, etc. A conference with one of our engineers and Sundstrand "Engineered Production" will determine the type and machine arrangement best suited to your work. There is no obligation for this service.

Brief Specfications

Complete specifications of the Model 55 vary according to type of arrangement, i.e., simplex, duplex or triplex. However, basic standard specifications in brief are as follows:

TABLE:

Feed Stroke, inches	72, 96, 120, 144 or 168
Table Widths, inches	18, 24, 30, 36 or 42
Feed Rates, inches per min	½ to 50 1 to 100

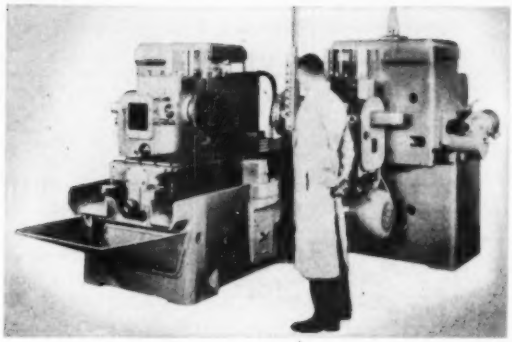
SPINDLE:

Endwise quill adjustment	8″
Vertical Adjustment (from spindle center to top of table)	5¾″ min., 20″ max. or 5¾″ min., 30″ max.
Spindle Nose	No. 50
Spindle Speeds, rpm	25 to 100 (in 2 models)
Spindle Motor	25 to 50 hp

For additional information on all Sundstrand Rigidmils and Sundstrand "Engineered Production", write for literature.

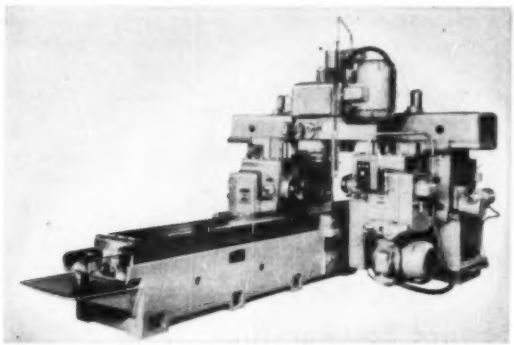
SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT



Duplex Type

Pictured above is the Model 55 with two horizontal opposed independently motor driven heads. Each spindle is mounted in a quill and has 8″ endwise adjustment. Spindle heads are mounted on adjustable columns, and power adjustment is provided for cross movement. Power clamping and unclamping is also provided for these moving members. Machine illustrated is used for finish milling both ends of a cylinder block. Cutters used are 14″ dia. carbide face mills.



Triplex Type

This highly productive Sundstrand Rigidmil has been developed to add flexibility to a production type milling machine so that both wide and narrow parts can be machined without sacrifice in accuracy. Three spindle heads, one vertical and two horizontal, can be adjusted to mill three sides of a work piece simultaneously or operate individually. Heads are independently motor driven. Machines can be furnished in table widths of 18″, 24″, 30″, 36″ and 42″ and feed strokes up to 168 inches with larger or special sizes available on request.

FREE DATA on all Standard Rigidmils and Sundstrand "Engineered Production" will be sent on request. Ask for Bulletin 198 for specific additional information on the new Model 55 Rigidmil.

Features

Among the many features of this new Model 55 Rigidmil are the following:

100 TO 1 RATIO FEED RANGE... Mechanical feed box with 100 to 1 ratio between high and low feed rate drives table feed screw. Feed box is of Sundstrand's patented design having two different driving gear shafts which greatly increases the range between the high and low feed rate and makes possible four different feeds with each set of two feed change pick-off gears. Two standard feed ranges of ½″ to 50″ or 1″ to 100″ per minute are optional. Dial or push button control of feed changes can be furnished as extra equipment.

CLIMB AND CONVENTIONAL MILLING... Addition of back-lash eliminator (standard) to table screw makes possible the positive feed necessary for climb milling.

SCREW FEED TO TABLE

SQUARE TYPE TABLE WAYS

HARDENED AND GROUND STEEL TABLE WAYS

AUTOMATIC LUBRICATION . . . All moving parts within machine are automatically lubricated. Easy to read sight gages permit quick check of oil levels in reservoirs.

30 TO 1 RATIO SPINDLE HEADS... The spindle heads also have two drive gear shafts. Thus, a much wider speed range can be obtained, and each set of two speed change gears provide four speed changes instead of the usual two speed changes. Heads of different horsepower capacities and speed ranges are available for this machine.

UNUSUALLY HEAVY SPINDLE . . . has heavy duty precision type front, intermediate and rear bearings.

AUTOMATIC TABLE CYCLES

EASY CHIP REMOVAL

ADJUSTABLE DWELL MECHANISM . . . For One Or Both Ends Of Table (Extra).

SECOND RATE OF FEED... For One Or Both Ends Of The Table (Extra).

VERTICAL POWER MOVEMENT... For Head (Extra).

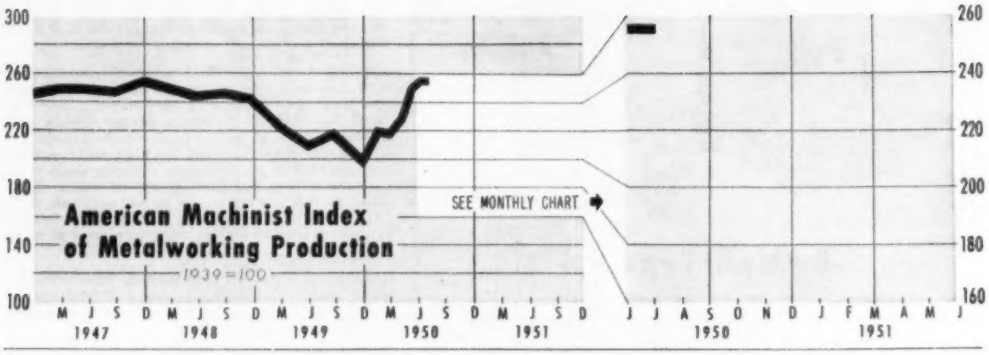
VERTICAL FEED TO HEAD... (Extra).

SUNDSTRAND MACHINE TOOL COMPANY

2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

Gaging Metalworking



Metalworking Production Zooms Skyward

Metalworking operations are headed skyward. In July, AMERICAN MACHINIST's Index was at 255, preliminary estimates show. That is same as in June, just short of the postwar high (257) of December, 1947.

• • •

This means that Metalworking today is at two and a half times the 1939 rate, based on manhours worked. August should bring no letdown. Plants making aircraft and plane parts have cancelled two-week vacation shutdowns and are running full blast. Makers of automobiles, appliances and other civilian items are pushing production before allocations force curtailments.

It's not day-dreaming to predict a rise in the AMERICAN MACHINIST Index to 275-280 by end of this year. Expansion in defense program, piled on top of unprecedented demand for peacetime goods, assures such an increase.

• • •

Just for sake of comparison, the highest point reached by the Index in World War II was 478 in November, 1943. From that time on, never again did production come up to the peak.

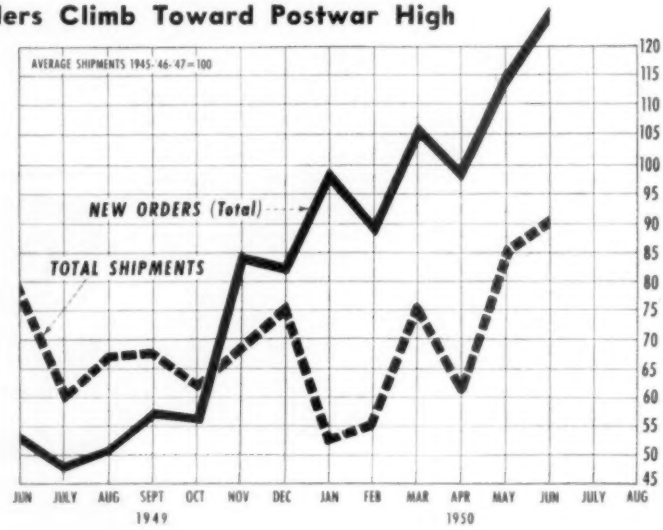
• • •

Transportation equipment industries have lagged in the upsurge of components of the index. But this group will gain momentum with growing activities in aircraft and shipbuilding.

June Machine Tool Orders Climb Toward Postwar High

	New Orders (Total)	Foreign Orders (Included in Total)	Shipments (Total)
1948			
Jan.	83.1	14.0	75.3
Feb.	77.3	12.7	87.1
Mar.	86.3	16.1	83.4
Apr.	86.3	14.1	82.0
May	73.5	11.4	82.6
June	83.4	11.9	94.4
July	74.0	13.3	62.4
Aug.	73.7	13.6	69.8
Sept.	73.1	11.6	84.7
Oct.	67.4	14.0	80.4
Nov.	72.2	18.1	76.2
Dec.	76.7	16.2	96.9
1949			
Jan.	87.0	21.9	68.8
Feb.	80.9	26.5	70.3
Mar.	93.5	22.3	75.8
Apr.	70.1	23.1	74.7
May	63.7	15.8	72.8
June	53.6	15.7	79.0
July	48.0	14.0	60.7
Aug.	51.5	18.8	67.3
Sept.	57.7	13.7	67.6
Oct.	56.8	13.7	62.3
Nov.	84.3	17.0	67.6
Dec.	82.5	22.4	75.7
1950			
Jan.	99.7	26.7	52.8
Feb.	89.2	18.8	56.1
Mar.	107.4	24.9	75.3
Apr.	99.2	17.6	61.7
May	116.4	18.4	82.5
June	p 126.2	p 24.1	p 90.4

Data: NMTBA p — Preliminary figures



INDEX

	JULY '50	JUNE '50(p)	MAY '50(r)	JUNE '49
	255*	255	248	216
Machinery		233	230	203
Electrical Manufacturing		296	292	229
Automobiles, Trucks		250	241	198
Transportation Equipment		228	221	242
Other Metalworking		273	261	231

AMERICAN MACHINIST'S INDEX OF METALWORKING PRODUCTION is based on manhours worked in the five components above.

*Estimated (p) Preliminary (r) Revised

Federal Reserve Board's index of industrial production is approaching the 200 level (double 1935-1939 average). It should rise another 10 to 15 points by year's end.

• • •

Prices are trending upward in almost all metalworking products. Raw materials costs and increased labor expense are blamed.

Escalator clauses are being resorted to by some companies as protection against climbing costs. In other cases, manufacturers will take orders only on basis of "prices at time of delivery."

• • •

Wholesale prices are up. At end of July, all-commodities index was around 164 (1926 equals 100). That is still 4% below peak of late 1948. By October, wholesale prices are expected to hit a new record high. Civilian business boom as well as war scare buying is responsible.

Cost of living (consumer prices) also is moving up. In mid-June it was 170.2 (1935-1939 equals 100), highest since January, 1949. New peak is anticipated by next December.

Korean war has had its effect on durable as well as consumer goods. Take big turbines for utility companies. Very few were ordered during all of 1949. Improvement first came last February, but buying still was only fraction of output. Last two weeks turbine orders have increased markedly. Result: turbine plant facilities of some companies are booked solidly until well into 1952.

• • •

Allocations appear sure on steel, copper, tin and aluminum. Scramble for steel is frenzied. Inventories in hands of users are low, mainly because steel has been chewed up so fast that consumers have had no chance to stock up.

Cut in steel allotments won't be so drastic, as matters now stand, that either automobile or appliance production will be sharply curtailed. Example: automobile rate might drop to 5 million units a year, compared with recent fantastic rate of 7 million.

• • •

Sales of metalworking production equipment have spurted. Machine tools are up sharply, press builders report phenomenal business, industrial-heating furnace orders are in much bigger volume (see New Tooling, page 77).

Gearing industry's orders went up 10.4% in June to 401 on index of American Gear Manufacturers Association (1935-1939 equals 100). Further gain took place last month, though figures are not yet at hand.

• • •

Business has gained all along the line in metalworking. Forge shops say that they are filled up. They anticipate capacity operations the rest of the year. While foundries are up at a high rate, some steel foundries in particular have notified customers that they still want all the business they can get from them, and please don't switch.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week index of activity (1923-1925 = 100)*	216.2	215.8	180.1
Steel ingot operations (% of capacity)	99.3	99.4	81.5
Electric power output (million kilowatt-hours)	6186	6006	5462
Production of automobiles and trucks	190,615	202,594	160,123
Engineering construction awards (Eng. News-Record; millions)	$252.5	$343.3	$131.8

MONTHLY BUSINESS INDICATORS

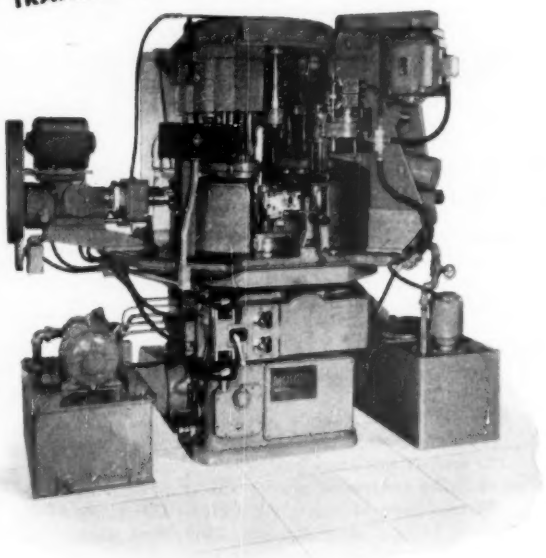
	Latest Month	Preceding Month	Year Ago
Index of industrial production* (1935-1939 = 100)	193	190	174
Index of durable manufacturers' production* (1935-1939 = 100)	228	222	201
Durable goods manufacturers' sales* (millions)	$9,013	$7,956	$7,488
Electrical machinery manufacturers' sales* (millions)	$919	$833	$741
Other machinery manufacturers' sales* (millions)	$1,382	$1,218	$1,229
Durable goods manufacturers' sales* (millions)	$8,780	$8,531	$5,993
Electrical machinery manufacturers' new orders (millions)	$908	$835	$584
Other machinery manufacturers' new orders (millions)	$1,486	$1,328	$986

*Seasonally adjusted.

One every 24 seconds

32 DRILLING & TAPPING OPERATIONS PERFORMED AUTOMATICALLY ON TRANSMISSION CONTROL VALVE BODIES

MORRIS *Mor-Speed* PRODUCTION MACHINE



A COMBINATION of Morris standard units . . . center column, base, indexing mechanism, hydraulic units . . . with a made-to-order vertical head, and auxiliary side heads, make up this high production machine. Use of the standard units, around which the high production unit is built, means that initial cost is much lower. In addition, the machine is more readily converted; design changes in the part *do not* mean the whole machine has to be scrapped.

Operating at 80% efficiency, the machine finished an automatic transmission control valve upper body with each index of the table. Part fixtures, hand-clamped, accommodate work pieces in two positions for the two cycle operation. A Morris 8-station center-column type unit, the machine is equipped with a 19-spindle vertical head, two hycycle motors for drilling operations, a six-spindle horizontal tapping head and a five spindle vertical tapping head.

If your work involves drilling, reaming, tapping or similar multiple operations on a production basis, investigate Morris Mor-Speed Production Machines. *Morris Engineers will gladly prove that high precision production can be yours . . . with worth-while savings in time, labor and space.*

THE MORRIS MACHINE TOOL COMPANY

"A better product at less cost— with MORRIS ENGINEERED PRODUCTION"

Builder of MOR-SPEED Line

933 HARRIET STREET CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Yesterday's Machines Won't Do

Our setbacks in Korea prove that we cannot win a war today with yesterday's weapons. What's more, we cannot carry out our war production program with the greatest efficiency and least waste by using machines designed in the 1930's.

WAR WEAPONS have changed radically since V-J Day. Today's airplane, for example, requires four times as many manhours to build as its World War II counterpart. It is twice as complex per pound of airframe weight and contains twice as many pounds.

It is powered with jet engines of complicated design. The engines present many new manufacturing problems involving development of new machining processes.

But these new military planes can fly much higher and much faster than the older ones. They are equipped with many new improvements in radar and fire-control apparatus, for instance, which call for great skill in metalworking production techniques.

OTHER WEAPONS tell pretty much the same story as airplanes. Tanks are bigger, have more firepower, are built of more resistant materials, are more intricate in design and more difficult to make than ever before. Guns and guided missiles demand painstaking accuracy in production so the requisite delicate balance is achieved.

It becomes obvious, therefore, that production methods used in World War II are as obsolete as World War II weapons. It also is clear that the tools employed in World War II are as obsolete as the weapons and production methods then.

If we are to utilize our manpower to best advantage in the critical days ahead, we must equip Metalworking with machines of postwar design. These machines are one-third to one-half more productive than the machines they will replace.

Labor costs of machining today are a billion dollars a year too much, as we point out in detail in an article beginning on page 107 of this issue. The nation can ill afford such waste at a time when our defense program is to cost us tens of billions of dollars a year for an indefinite period ahead.

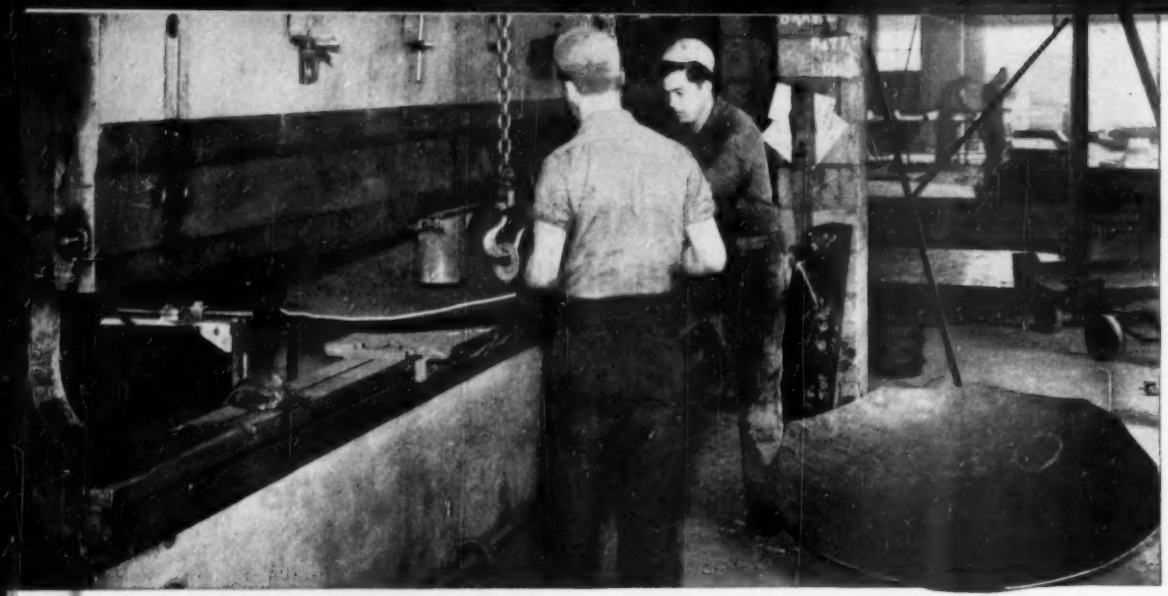
THE REASON for this wastage is that metalworking companies are not yet applying in their shops the increased productivity to be derived from the newer machines now available.

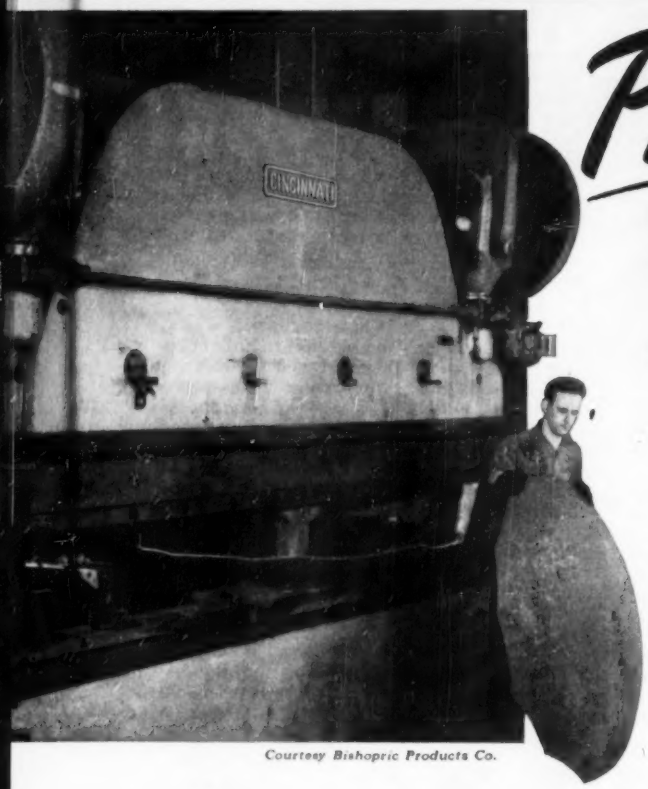
But there is hope. Metalworking manufacturers are rapidly waking to their opportunities. In the past few weeks they have ordered these new machines in larger numbers by far than ever before.

They are beginning to recognize that the military production goal to which we are committed cannot be attained in our shops with obsolete machines and techniques any more than our military objectives can be reached in the field with obsolete weapons.

Still better, this laudable start is being made without official prodding from Washington and without activation of "phantom orders" by the National Security Resources Board.

Burnham Finney





Courtesy Bishopric Products Co.

Profitable VERSATILITY

for JOBBING WORK!

Cincinnati All-Steel Press Brakes are used profitably for bending, punching, press work and a great variety of jobbing applications.

Dished heads, a common problem in the tank field, are being formed on this Cincinnati Press Brake in a range of sizes with simple low-cost dies and without change in setup.

This Cincinnati Press Brake, with equally low-cost tooling, simplifies difficult sheet metal and plate jobs and is a versatile, profitable and busy tool in any fabricating shop.

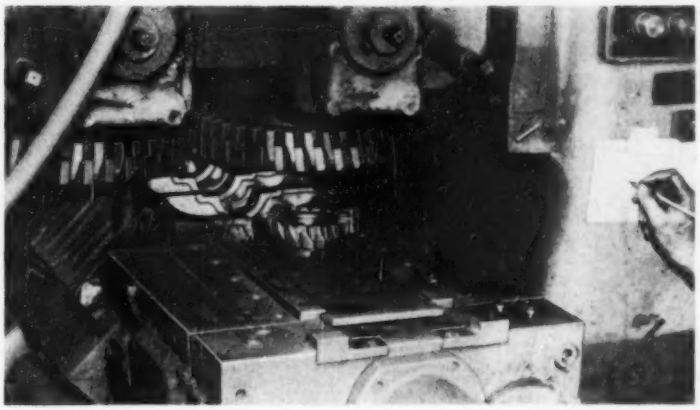
Write for Cincinnati Press Brake Catalog B-2A.

CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES



Three Times As Long Between Grinds — Serrated-blade milling cutters are being tested against standard cutters in milling cylinder blocks. In this setup, the new cutters run about three times as long per grind, thus promise substantial savings per piece in machining costs. Taped to the side of the machine (right) is a record blank, on which the operator enters data as instructed by the Trials & Tests man in charge

TRIAL & TEST GROUP PAYS OFF

The "Welcome" sign is out for cost-saving ideas at Cadillac. Five men, all specialists and shop men, answer only to top production executives. They test every idea, from employee or from vendor, in the shop, and have the authority to put worthwhile ones into practice

BY T. NORMAN CHAMBERS

Supervisor of Trials & Tests

Cadillac Motor Car Division, GENERAL MOTORS CORP.

VENDOR suggestions for changes in materials and methods during World War II proved so helpful to the Cadillac Motor Car Division, General Motors Corporation, that this Division has set up what is termed a "Trials & Tests Group." This group, answerable only to the assistant works manager and to the master mechanic, makes continuous tests of methods, tools, and materials within the plant to lower costs and to improve the Division's own products. It now consists of five men.

This group welcomes suggestions for changes, whether submitted by Cadillac personnel or by outside sources, including vendors, maintaining an open mind as to what may or may not be accomplished by the proposed change. If the suggestion appears to merit trial, tests are run in actual production and careful records are kept of the results.

Records kept are ultimately worked out to show the saving per car that will result. When it is shown that the saving or improvement in product quality justifies a change, allowing for whatever investment may be required, this change is put into effect.

Persons directly concerned witness the tests and participate fully in credit for any benefits secured. This policy has been so successful that the group's help is often sought, especially when troubles arise. A solution is usually found quickly, partly because the five men in the group are all shop men and have much experience along most of the lines in which their help is sought.

Savings already brought about by the group are substantial and most such savings continue as long as the operation runs. New and additional possibilities for savings are constantly being investigated. Employees' suggestions are weighed and if found to be new and promising, are given suitable trial. The suggestor benefits from this procedure, as he needs to submit only the basic idea, which is then expanded and developed during the trial period.

Another source of information is found in articles describing new methods which appear in metalworking publications; these are carefully studied.

Shop Is the Laboratory

To accomplish its results, Trials & Tests does not maintain a laboratory or, to put it another way, it

TOOL COMPARISON CHART — RECORD NO. 101

DATE 10/16/49 — TOOL NAME SUBLAND DRILL-V-STANDARD

TOOL NUMBER 1441264-T-49 — PART NAME G-3AP-REAR AXLE RING

PART NO. 1441833-1284 — OPER. NAME DRILL #1, -355- .359 HOLES

OPER. NO. —

		SUBLAND	STD
1.	Cost of tool (Purch. Price in quantity desired)	4.10	1.10
2.	Avg. pieces per Grind (See other side of card)	20	200
3.	Minutes per grind (Avg. or Est. time C.G.)	8	6
4.	Cost per Grind	20	15
5.	Grinds per Tool (Actual or Est.-Indicate)	18	20
6.	Grinding Cost per Tool (Item 4 x Item 5)	3.60	3.00
7.	Minutes to change tools (Actual or Est.-Indicate)	5	5
8.	Cost to change tool	.12	12
9.	Changing cost per tool (Item 5 x Item 8)	64.8	60.00
10.	Pieces produced per tool (Item 2 x Item 5)	360	4000
11.	Total tool cost (Item 1 plus Item 6 plus Item 9)	72.50	64.10
12.	TOOL COST PER PIECE (Item 11 divided by Item 10)	.20	.012

Tool Description
Tool Number
Vendor, etc.

	Tool 1 Stock Pr.Gr.	Tool 1 Pcs. Pr.Gr.	Tool 2 Stock Pr.Gr.	Tool 2 Pcs. Pr.Gr.	Tool 3 Stock Pr.Gr.	Tool 3 Pcs. Pr.Gr.	Tool 4 Stock Pr.Gr.	Tool 4 Pcs. Pr.Gr.	Tool 5 Stock Pr.Gr.	Tool 5 Pcs. Pr.Gr.	Tool 6 Stock Pr.Gr.	Tool 6 Pcs. Pr.Gr.
NEW GRIND		20		198								
1ST GRIND		18		203								
2ND GRIND		17		196								
3RD GRIND		22		205								
4TH GRIND		20		206								
5TH GRIND		23		190								
TOTAL		120		1198								
AVERAGE		20		200								
Stock Avail.												
Not grd.												

Trial & Test Card—On this card, records of tool performance are entered during a test. If the test is successful and the tool is adopted, the record is continued. Changes are indicated as they are made. If the new tool fails to continue giving the advantages indicated by the test, further checks may be made to find out why. Often further changes give still better results. If carbide is involved, make and grade are recorded for reference

uses the shop itself as its laboratory, because tests are almost invariably made on the particular job or jobs where they will be used if successful. This is done, of course, with due judgment and with the full cooperation of the foreman concerned, so it does not interfere with regular production, even temporarily, to any significant degree.

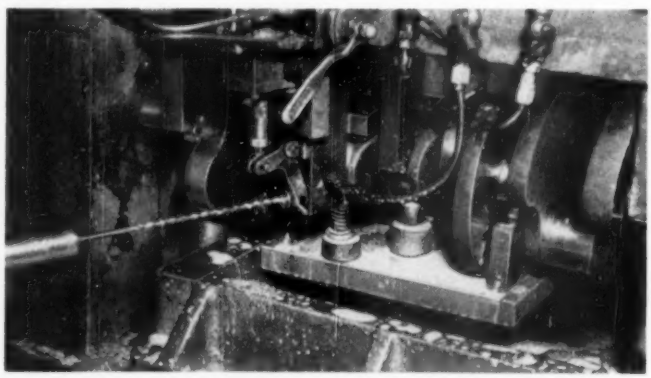
If a vendor is concerned, he may witness the test to make sure that no significant factor is overlooked. In many cases, vendors not only witness tests but make invaluable suggestions based on their own experience in more or less parallel cases in other shops. Sometimes they even supply special tools for trials. Tests are run, however, under normal production conditions on such machines as are available, generally those that will be employed if results justify a change. One individual from the group supervises the test and may remain in constant attendance. If, however, the test takes days or even weeks to complete, he tells the foreman and machinist on the job what to watch and leaves with them a form on which the essential particulars are recorded. He returns from time to time, as may be needed, to check the results secured and finally fills out the necessary report cards.

The test group is not charged with setting up performance standards or with layout of new processing lines when they are required. On the other hand, the group may be consulted on procedures it has investigated, and has authority to change procedures where its tests have shown benefits.

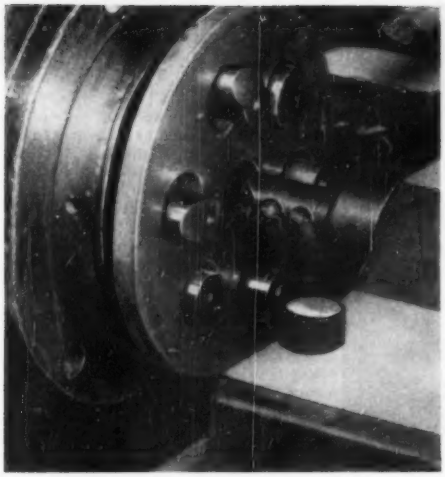
Each Man a Specialist

Each of the five men in the group specializes in certain types of work, but they often pinch-hit for each other. Prior records may even indicate the answer to a new problem —or at least point to similar cases or to the the course to follow.

One man of the group specializes in cutting tools, including, of course, the various grades of car-



Carbide Drill Bushings Pay Out—In drilling the crankshaft on an Avey Torque-Matic, it is essential that bushings next to the work guide the drill against runout, or holes will be outside tolerance limits. Hardened steel bushings lasted 4 to 15 days. Trials & Tests substituted carbide bushings, which last 5 weeks to 6 months. This cuts labor cost for downtime and replacement and cuts scrap loss from rejected crankshafts misdrilled through worn bushings



Once a Shift to Once a Week—HSS tools formerly used to bore gear sprockets in a Sundstrand lathe required regrinding and resetting each 8 hours. Replacing them with carbide tools cut frequency of resetting to once a week

bides, and is well versed in proper grinding techniques as well as in speeds and feeds that have improved best under given sets of conditions. A second man specializes in welding. A third is a specialist in materials-handling methods and suggests changes both in methods and in equipment, including, in some cases, special forms of tote boxes or trucks designed to facilitate handling and to avoid damage where this has become significant. The fourth man deals with a variety of mechanical and processing problems with which others are less directly concerned. Finally, the fifth man supervises the activities of the other four, reports to superiors, aids in keeping records and sees that the group lends cooperation where it is needed.

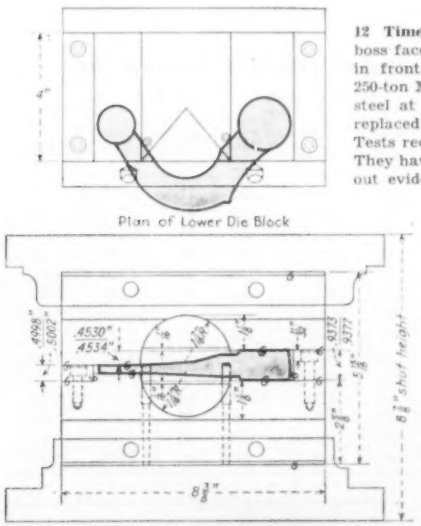
When new or revised procedures or tools are found beneficial on certain operations in one department, the facts are passed along, usually by word of mouth, to other departments that may profit. This generally results in a request for trials to determine whether corresponding benefits will be obtained.

Hard-Surface Tools

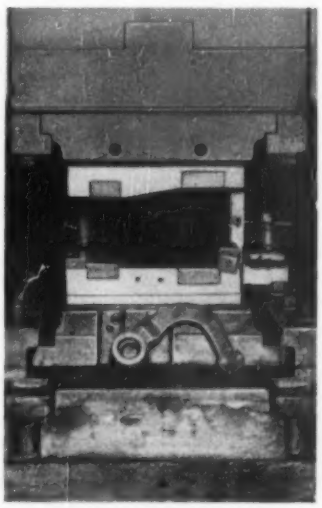
An indication of one type of benefit secured is given in the accompanying table listing the results of certain tests with tools having normal or "untreated" surfaces and of corresponding tools that have been given a nitride ferrox, or a substantially equivalent, surface treatment. In all the cases recorded, a worthwhile increase in pieces per grind and per tool was found to result from such surface treatments. This probably will result in much more general use of the specially treated tools, but adoption has been delayed because in some instances a large increase in original cost of tools is charged while, in other cases, an equivalent special finish is becoming available at slight or no extra cost. As soon as this situation is further clarified, a substantial shift in favor of the special-finish tools is anticipated.

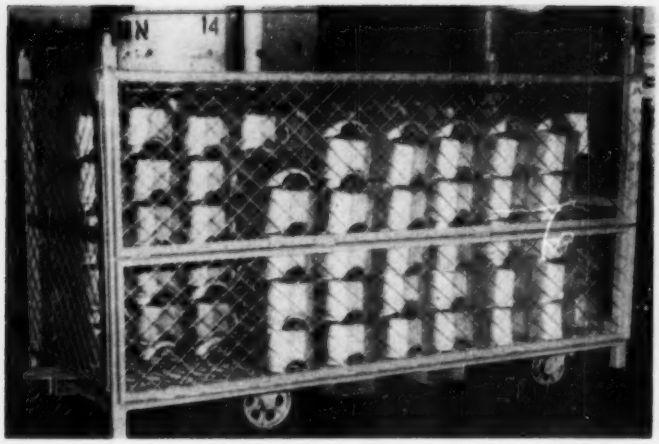
Make Welding Improvements

Bumper guards were arc welded with mild-steel unshielded electrodes. The welds looked good on the surface but, when ground, showed pits that gave trouble in plating and resulted in a high rejection rate. Changing to an argon-shielded arc resulted in a superior weld and one in which, if any pitting occurred, it showed on the surface and could be repaired. This



12 Times More, So Far—Coining boss faces of the forged lever lying in front of the die is done on a 250-ton Minster press. Inserts of die steel at pressure points had to be replaced after 5400 pieces. Trials & Tests recommended carbide inserts. They have coined 70,000 pieces without evident wear





Caging Avoids Damage—Oil pans do not nest, yet must be transported long distances within the plant. Handling on ordinary skids didn't work—there were delays and losses, partly because pans fell off in transit. This container, with strong netting sides, has half of each side hinged longitudinally to drop down for loading and unloading. Racks can be stacked to save floor space if necessary and can be handled by tow or fork truck as desired. Precise savings are not available, but damage has been eliminated. Special equipment of this type is not provided unless it can pay for itself in less than two years

change not only practically ended rejects and saved excessive grinding costs but also increased output from 130 welds to 200 acceptable welds per man per day.

In making these welds initially with a common mild-steel filler wire, considerable hardening occurred at the weld. This was overcome by substituting a NAX low-alloy rod that gave a weld whose hardness approximates that of the adjacent unhardened mild-steel surface and effected savings in dressing time.

Argon consumption proved to be high initially, but was minimized with a substantial added saving by developing, in cooperation with the vendor, a device to permit gas flow only while the arc is energized, except for a short time delay to cool the tungsten electrode momentarily at the end of the weld.

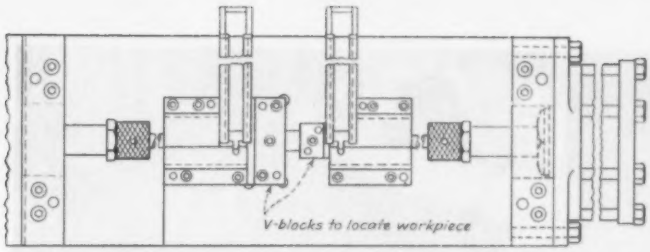
When welding was first investigated, only dc equipment was used and turbulence made for poor welding. Substitution of high-frequency ac equipment resulted in better welds. These are now even made on work already plated with copper, nickel and chromium on low-alloy steel. If copper permeates the weld, the weld is embrittled and lacks strength. Tests have shown, however, that if current is properly controlled and if a copper backing with a recess directly below the weld is used, the copper "falls through" to the bottom of the weld bead, leaving any embrittlement on the underface where no strength is required and the embrittlement does no harm.

These and pictured items are only examples, but they illustrate the type of savings the Trials & Tests Group has obtained. This group has been "feeling its way" to a certain extent, but has attained savings that are substantial and greatly exceed the costs involved. These and other benefits realized have convinced management that the project is very much worth while.

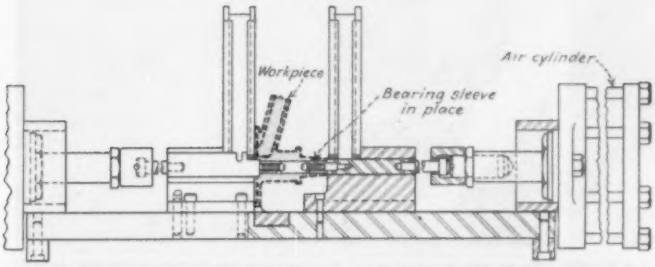
SUMMARY OF HS STEEL TRIALS WITH AND WITHOUT SURFACE TREATMENT

TYPE OF TOOL	OPERATION	UNTREATED			TREATED*			% Increase
		Pcs/ Grind	Grinds/ Tool	Pcs/ Tool	Pcs/ Grind	Grinds/ Tool	Pcs/ Tool	
Fellows Cutter	Shape Teeth, Counter Gear	30	18	540	75	18	1,350	150
Hob	Mill Spline Axle Shaft	240	20	4,800	450	20	9,000	87
Hob	Mill Spline Trans. Shaft	108	20	2,160	210	20	4,200	94
Hob	Mill Spline Pinion Drive	455	20	9,100	655	20	13,100	43
1 15/64 Drill	Drill Steering Knuckle	75	32	2,400	150	40	6,000	150
63/64 Drill	Drill Steering Knuckle	75	32	2,400	150	40	6,000	150
Reamer	Ream W.P. Hole	500	12	6,000	920	20	18,400	206
Form Mill. Cutter		400	22	8,000	900	28	25,200	186
27/32 Drill	Drill Steering Knuckle	50	40	2,000	100	35	3,500	75
3-Step Reamer	Auto. Screw Machine	50	25	1,250	400	35	14,000	1,020
Broach	Broach Keyway	3,000	6	18,000	4,500	6	27,000	50
Spec. Reamer	Valve Guide Bushing Hole, Cyl. Block	300	10	3,000	8,000	10	80,000	2,566
9/16 Drill	Oil Gallery	130	35	4,550	700	48	33,600	638
5/8 Drill	Cyl. Block, Valve Guide Bushing Hole	50	32	1,600	125	40	5,000	212
29/32 4L Drill	Steering-Knuckle Support	50	40	2,000	100	60	6,000	200

* Nitride ferrox—two treatments, standard nitriding (either bath or gas) followed by "ferroxing"—subjecting to oxidation in steam vapor at 1000-1100F, creating Fe_3O_4 surface and giving extra drawing.

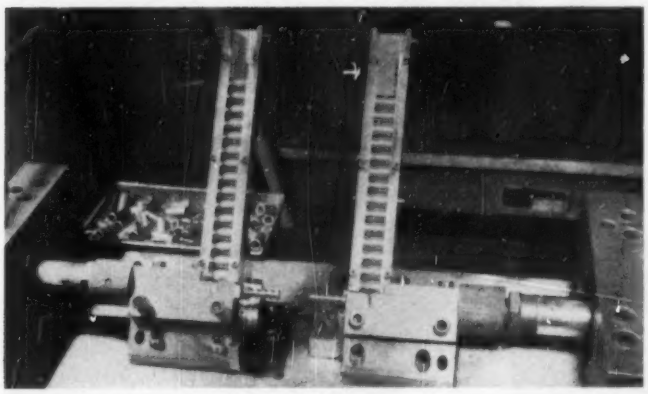


AIR POWER SAVES ASSEMBLY TIME

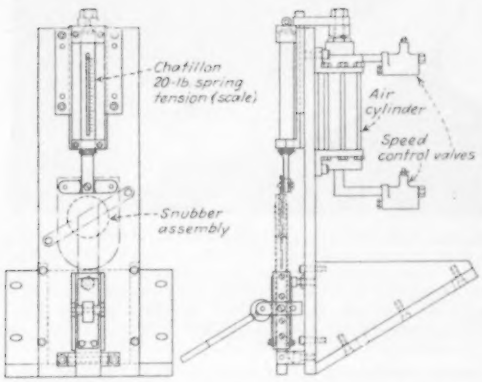


Simple, inexpensive fixtures reduce operation-cycle time and maintain quality by applying desired amount of pressure at a predetermined rate

BY GEORGE W. LESSMAN, Supt.
AUTOMATIC CLOTHES WASHER DEPT.
HOT POINT, INC.

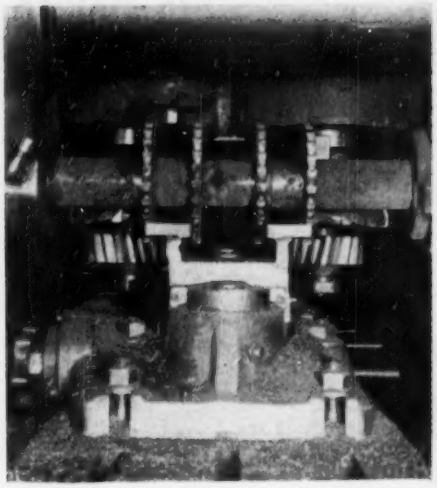


Double-acting air cylinder at each end of assembly fixture pushes square plunger through guide block to insert bearing sleeve into each end of pump housing. Burnishing tool on end of each plunger pilots sleeve during insertion and finishes bore. Sleeves are fed through chutes, and V-blocks hold housing in alignment with plungers so a 0.375-in. shaft will pass through both 0.376-0.0377-in. bores.

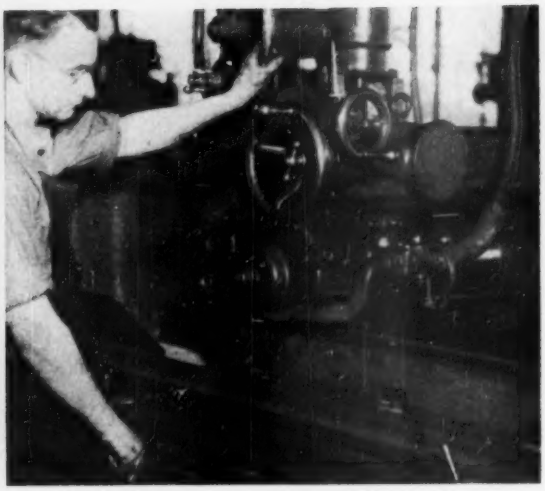


Snubber tension fixture checks spring tension of snubber pads against steel plate. Air cylinder holds the tension gage to relieve operator fatigue. Speed-control valves at each end of double-acting cylinder are connected to single,

foot-operated control valve to move gage slide up and down tilted faceplate mounted on bench, as shown above. Adjustments are made within close limits with the work on the fixture



Flat lathe bedways are milled on a special K & T mill with this gang-cutter setup which machines the top and bottom and both sides of each way in a single pass. On a 54-in. bed, time is 8 min floor to floor. Operation is repeated as a finishing cut after stress relieving

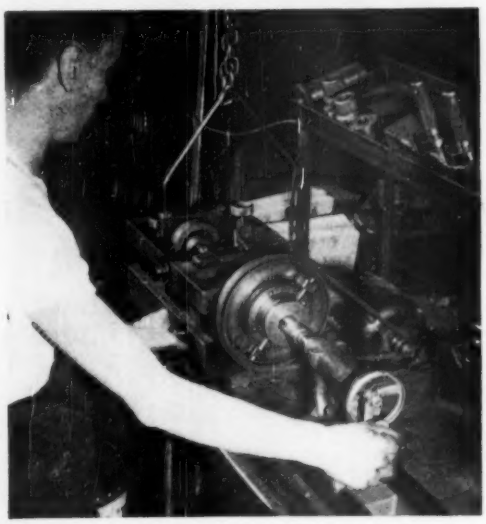


Twin-wheel setup on a Norton grinder finish-grinds the top of both ways. Work is supported on lower face of ways in channel-type fixture and is clamped by bolts passing through openings in the bed. Cuts are light to avoid distortion and to produce the desired fine finish without costly hand scraping

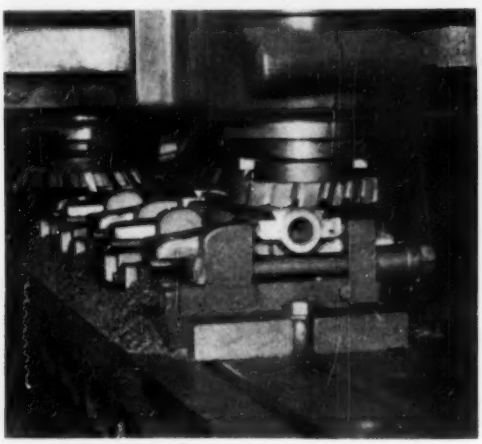
SHOP SHOTS

at

ATLAS PRESS



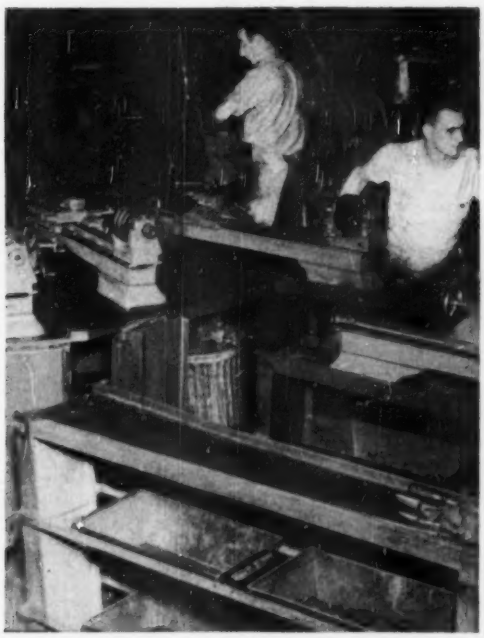
Headstock finish boring is performed by hand with a special boring tool and with headstocks set up on their respective beds. This insures absolute parallelism of the spindle bore with the bed. Tailstock is jig-bored and fitted by grinding the base. It is left 0.001 in. high to allow for settling after being in use for a short time



Special combination milling setup on a K & T milling machine. Two horizontal cutters mill square steps, two vertical angle cutters undercut steps to form dovetails, and third vertical cutter face mills top face of cross-slide castings. Fixture holds three pieces and milling time is 12 min per load

Unusual setup for grinding both edges of both ways simultaneously. A standard planer has been equipped with four Ex-Cell-O grinding heads. Dressing diamonds are attached to planer table and so arranged that all wheels are dressed before each pass. Ways are thus held parallel within 0.0005 in. Lower edges are ground in a separate operation

Flatness check is made on every lathe bed by a feeler gage and surface plate. Ways must be flat within 0.001 in. Similar checks are made on miller and drillpress tables and ways



Transfer table permits partly assembled lathes to be routed to any one of three progressive assembly lines. Work slides from station to station in steel channel sections which make for easy handling and keep beds level. Subassemblies are prepared on side benches and fed to the lines at appropriate points

End of the line. Lathes are given 100% inspection, run in under power, and checked for concentricity and parallelism by indicator checks and actual turning and facing operations as done in industry. Accepted lathes are greased, wrapped, and crated immediately for delivery to shipping room or storage

SELECTION OF PRODUCTION MILLING PROCESSES...III

String milling is an effective and economical method of milling a great variety of small parts. Since production work is involved, it will pay to study the four principal variants of string milling, in order to select the one which will give the greatest number of pieces per hour

BY MARIO MARTELLOTTI, THE CINCINNATI MILLING MACHINE CO.

TO SAVE handling time, two or more parts are sometimes placed in a row in the direction of the table feed, so that they are milled in consecutive order. This method is known as string milling. Several variations of string milling are used in practice, according to the manner in which parts are placed in the fixture.

Parts Placed Close Together

The ideal condition for string milling is shown at *A*, Fig. 1. Here the parts are placed close together as by stacking on a mandrel, Fig. 2. The job consists of milling notches on a number of adjusting nuts. This version of string milling is equivalent to single-piece milling, except that as many nuts are milled per cycle as can be stacked on the mandrel. Time required to unload and load the mandrel is not considered in calculating cycle time, since this work can be done with a spare mandrel while the machine is milling.

To complete the operation, it is necessary to index the mandrel a number of times equal to the number of notches minus one. Therefore, the cycle time per piece is:

$$t_c = \frac{(t_m + t_i + T_s)\,n + T_s\,(n-1) + t_s'}{n_s}$$

where:

t_c = cycle time per piece, min.

t_m = time required to mill one notch in n_s nuts, min.

t_i = idle machine cycle per notch in n_s nuts, min.

n = number of notches to be milled in each nut.

T_s = time required to index (repeated as many times as the number of notches minus one), min.

$t_s' = T_s + T_s$ = time required to remove mandrel from the fixture after milling n notches and replace with a new mandrel min.

T_s = time required to start cycle, min.

n_s = number of nuts on the mandrel.

Note: For further information on the expressions used in the above formula, refer to page 91, July 10, 1950 number.

There are 24 nuts on the mandrel in this particular application. Each nut has four notches, spaced 90° apart. These notches are milled consecutively by indexing three times. Hence, the above formula can be written:

$$t_c = \frac{4\,(t_m + t_i + T_s) + 3T_s + t_s'}{24}$$

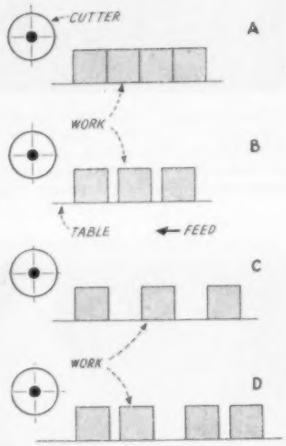


Fig. 1 . . Spacing and grouping of parts for string milling will depend on the type of clamping or fixture used. Formulas are given to determine the cycle time per piece for the four methods shown

Individually Clamped Parts

Parts are sometimes spaced apart in the fixture and individually clamped, but with the spaces between them so narrow that they can only be traversed at the feed rate of the table, as at *B*, Fig. 1.

A practical example of this arrangement is the milling of a slot in the head of special screw blanks, Fig. 3. The blanks are dropped into locating holes in the fixture, and are clamped individually by means of side screws. Parts are arranged in two rows abreast.

Abstracted from a "Treatise on Milling and Milling Machines," which will be published at an early date.

The cycle of operations is the same as that shown in Fig. 4, page 92, July 10 number. The parts in each row can be treated as a single piece having a length of cut:

$$L_s = n_s w + (n_s - 1) s$$

where:

L_s = total length of cut, in.
n_s = number of pieces in a row.
w = diameter or width of each piece, in.
s = space between two pieces, in.

Since approach A and overtravel O for n_s pieces are the same as for one piece, the milling time per piece would be expressed as:

$$t_m = \frac{n_s w + (n_s - 1) s + A + O}{F}$$

developing:

$$t_m = \frac{n_s w + n_s s - s + A + O}{F}$$

The milling time is at a minimum when s is equal to or less than $A + O$. At A in Fig. 1, $s = O$

Taking $s = A + O$, then:

$$t_m = \frac{(w + s) n_s}{F}$$

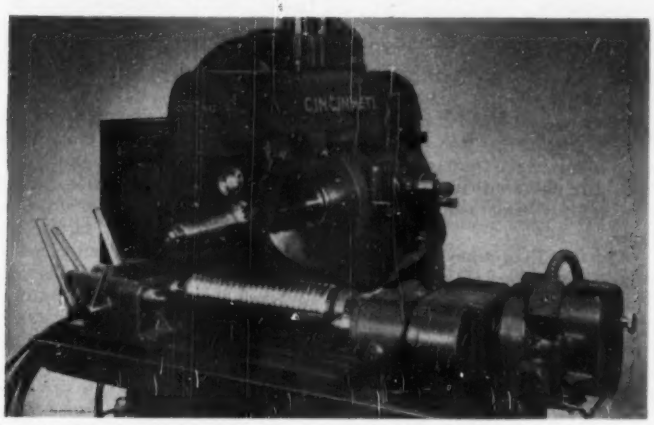


Fig. 2 . . Workpieces are stacked on a mandrel to achieve the conditions of method *A*. Fig. 1. By using a spare mandrel, no milling time is lost in loading and unloading of mandrel

Fig. 3 . . Special screw blanks are placed in the fixture two rows abreast for string milling according to method *B*. The fixture is mounted on a knee-and-column milling machine

When parts are placed so closely together that the space between them is considerably less than the overtravel plus the approach, the number of parts to place in each row can be calculated as follows:

$$n_s = \frac{A + O}{s} + 1$$

From this formula, it can be seen that if $s = A + O$, then $n_s = 2$; and likewise, if $s = (A + O)/2$, $n_s = 3$.

In the case illustrated in Fig. 3, the space between the parts is $s = (A + O)/6$, and accordingly seven parts are placed in each row.

The idle cycle time when s is taken equal to $A + O$, and L_s = minimum safe distance of loading position from cutter, for all pieces is:

$$t_i = \frac{n_s w + n_s s + 2L_s}{R}$$

The operator may begin to unload the blanks on the forward end of the fixtures when they are at a safe distance from the cutter, and while milling the rest of the blanks. After returning the fixture to the starting position at the completion of the milling stroke, and while the machine is idle, the only handling time t_h to be accounted for is that spent by the operator in reloading the first two or three stations. The operator will then re-start the cycle and complete the loading while milling proceeds on the pieces already placed in the fixture.

If t_h is the handling time per piece and n_i is the number of parts which are handled while milling, then the handling time to be accounted for is:

$$t_h' = (n_s - n_i) t_h$$

where:

t_h' = handling time to be accounted for, depending on the number of pieces not handled while milling, min.
n_s = number of pieces in a row.
n_i = number of pieces handled per cycle while milling.
t_h = handling time per piece, min.

The cycle time per piece for string milling of Type B can now be calculated by means of the fol-

lowing formula, obtained by adding the formulas for t_m, t_l and t_h', and dividing by the number n_s of pieces in each row:

$$t_c = (w + s)\left[\frac{1}{F} + \frac{1}{R}\right] + \frac{2L_s}{n_s R} + \frac{n_s - n_l}{n_s} \times t_h$$

where:

t_c = cycle time per piece, min.
w = dia or length to be cut, in.
s = space between pieces, in.
F = table feed rate, ipm
R = table rapid rate, ipm
L_s = minimum safe distance of loading station from cutter, in.
n_s = number of pieces in a row.
n_l = number of pieces handled per cycle while milling.
t_h = handling time per piece, min.

The preceding formula would give the time per piece when placing parts in one row. Since there are two rows abreast in the application shown in Fig. 3, the time t_c per piece for this case would then be obtained by dividing by two the result obtained from the preceding formula.

If the specific values in this formula are replaced by the generic terms t_m and t_l, it can be written:

$$t_c = \frac{t_m + t_l + (n_s - n_l)\, t_h}{n_s}$$

where:

t_c = cycle time per piece, min.
t_m = milling time for n_s pcs, min.
t_l = idle machine cycle time n_s pcs, min.
n_s = number of pieces milled per cycle, or the pieces in one row
n_l = number of pieces handled per cycle while milling
t_h = handling time per piece, min.

Combination Grouping of Parts

If all the pieces can be handled while milling, then $n_l = n_s$, and the handling time in the preceding formula is zero. In this case, the time per piece will consist only of the milling time and idle cycle time.

The handling time can be reduced to zero by: (a) using a rise-and-fall milling machine in which the spindle carrier and, consequently, the cutter can be withdrawn at the proper moment in the cycle; and (b) grouping and spacing the parts, as shown in views C and D, Fig. 1, so that one fixture can be unloaded and reloaded while milling the parts in the other fixture. Thus, handling time is saved, because no interruption results in the cycle; provided, however, that it is possible to follow the cycle at the rate determined by the machine.

In any application of this sort, the cycle is arranged so that the table will stop after milling the piece in the first fixture, thus allowing the operator to complete loading the second fixture and restart the machine cycle. This particular milling method may be used as shown in view C, Fig. 1, or as a combination of conditions B and C, shown diagrammatically in view D.

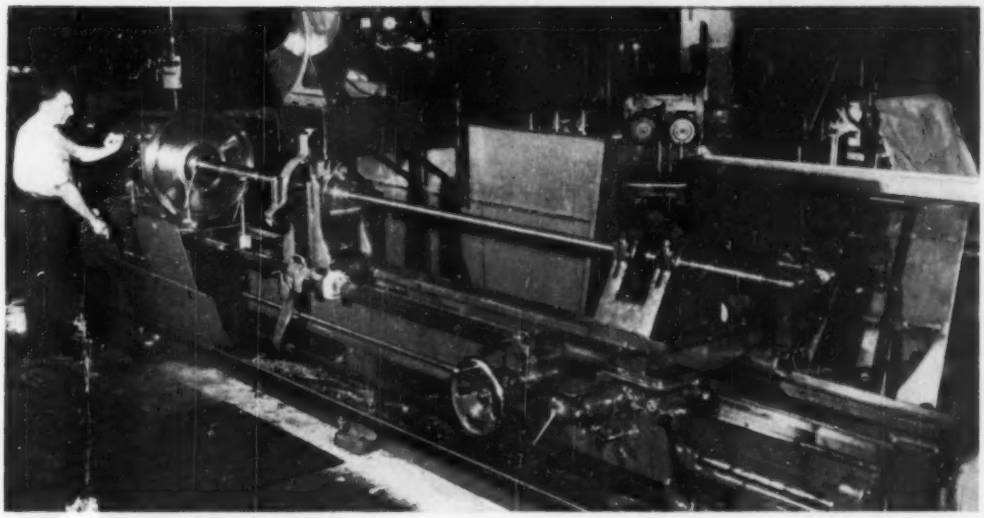
A practical version of the string milling method shown in view D is illustrated in Fig. 4. In this operation, the edges of pruning shears are form milled. To produce the contour, the spindle carrier is guided by a cam roller attachment at the rear of the machine. The cut is taken by down milling with a form relieved cutter.

While the machine is milling the two pieces in one station, the operator unloads and reloads the second station. He then proceeds to unload and reload the first station while the parts in the second station are being milled. At the completion of the table stroke, the spindle carrier rises and the table is returned to the starting position, after which the cycle is repeated.

The elements of time which determine the time required to mill one piece are the milling time and the idle machine cycle time. The handling time is not included, since the fixtures are loaded and unloaded while milling. The general formula for the time required per piece is similar to the last formula above and is obtained from this formula by taking the term for the handling time equal to zero. Since the number of pieces handled per cycle while milling is, in this case, equal to the total number n_s of pieces milled per cycle, $n_s = n_l$.

Another installment on production-milling methods will appear in the August 21 number.

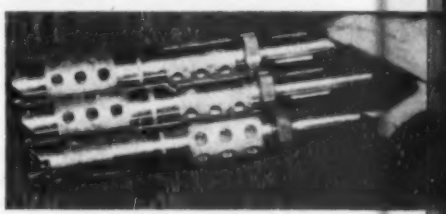
Fig. 4 . . To form mill the conical-shaped edges of pruning shears, the parts are string milled according to method D. The operator unloads and loads one pair of fixtures while milling is being done at the other two fixtures



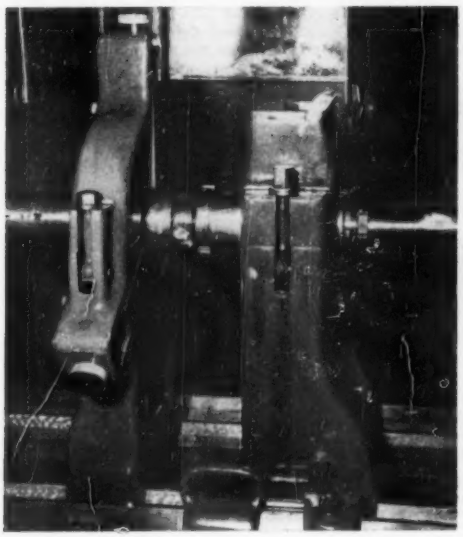
Deep-hole drilling a gas-turbine impeller shaft on an American Pacemaker lathe at Wright Aeronautical Corp. Shaft is 57 in. long, and first operation is to drill 1⅞-in. hole 50¾ in. deep, and 1¼-in. hole through, blend with 15° angle, and center one end. Finishing operation re-bores 1⅞-in. hole to 1.990 in. and re-blends it with smaller hole. Concentricity with 3 bearing dias must be held within 0.002 in. for full length of bore

Lathe Drills Long Shafts

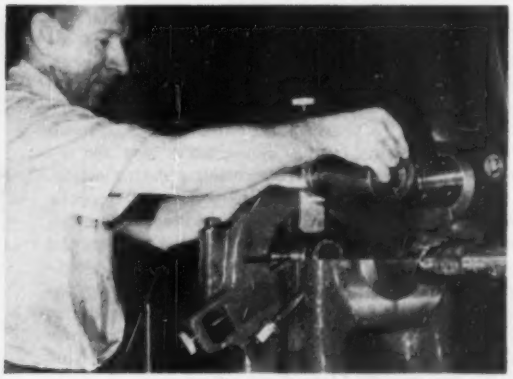
Ingenious setup drills stepped hole 57 in. long in turbine shaft



BY H. E. LINSLEY, ASSOCIATE EDITOR



Roughing cutters have stellite guides, operate at 0.008-in. feed and 145 rpm for 1¼-in. hole, 115 rpm for 1⅞-in. hole, and 44 rpm for blending and centering. Finishing cutters (shown) have HSS blades and hard maple wood packs 0.004 in. larger in diameter. Three cutters are 1.940, 1.980, and 1.990 in. in dia. Cuts are made at 304 rpm with 0.0075-in. feed



Roller steadyrest, plus special bushing-support carriage, provides control. Roughing cut is chuck driven; finishing with an adapter and hollow centers to clear tool. Oil through hollow boring bar at 1500 psi clears chips

IF *you are burring small gears by hand,*

IF *burrs wipe from one surface to the other and fail to cut clean,*

IF *burring is costing you too much, then you may want to . . .*

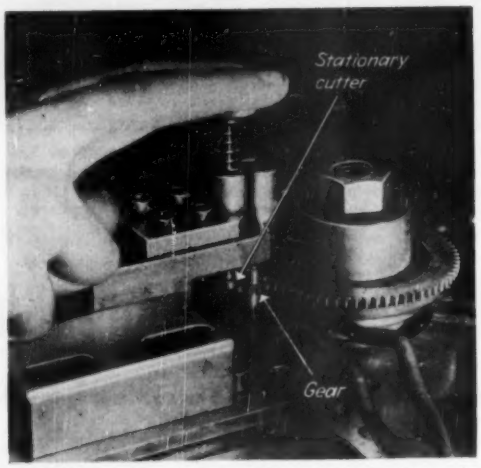
TRY THIS ASPIRIN FOR GEAR-BURRING

BY ALBERT P. OHR, Tool Engineer
MONROE CALCULATING MACHINE CO., ORANGE, N. J.

THE DIFFICULT job of removing burrs from gear teeth is a fast, trouble-free operation at Monroe Calculating Machine Co. Burrs are removed from the sides of gears and between their teeth in one continuous operation in special machines of our own design. These machines handle both spur and slight-angle helical gears and a limited number of internal ring gears. They burr gears of any generated tooth form, and remove all burrs without removing base material from the gear. Thus, tooth form, size, accuracy, and all other characteristics in the gear are in no way affected by the operation. No subsequent hand-filing or wire-brushing is necessary, and most gears are burred in a single revolution of the burring tool.

Burring is accomplished through the combined action of a reciprocating burring cutter mounted on a shaft at the center of the machine, and a stationary single-edge cutter mounted in the workholding fixture. The reciprocating cutter is of conjugate shape to the gear teeth and rotates at the same time that it reciprocates. The gear to be burred is mounted on a pin in the workholding fixture, which then is advanced along slides on the machine table until the gear meshes the cutter. Reciprocation of the cutter is about ⅛ in. and is set so cutting surfaces rise just far enough above the side of the gear to turn all burrs between the gear teeth to the side of the gear. Then, as the gear rotates, burrs are cut off by the stationary cutter which acts against the lateral face of the gear at a point 180° from the point of mesh with the rotating cutter. Some burrs also are removed directly by the reciprocating cutter action.

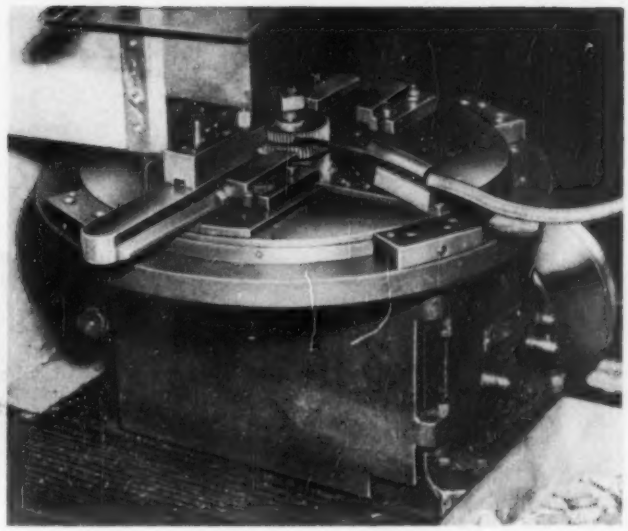
The machine runs continuously with no stopping and starting to load or unload the fixtures. The operator simply pins the gear in place, advances the workholder, holds the gear in mesh for approximately one revolution of the cutter, retracts the workholder, and removes the gear. The cycle is so short that we have not followed through on our original idea of providing a four-position indexing table and burring three gears simultaneously at the 90°, 180° and 270° stations while the operator works at the fourth position. The operator then would index the fixture, unload a completed gear, load an-



Workholder is moved along slide to bring gear in mesh with reciprocating cutter. Operator then holds spring-loaded stationary cutter against side of gear to cut off burrs. One revolution of cutter completes most gears; production is over 200 gears per hour for 1-in. pitch diameter

Reciprocating cutter consists of two sections fastened together and with spacer between them to produce gap. Cutting edges are on each side of gap

HEADACHES



Gear-burring machine removes all burrs from sides of gear and between gear teeth in one continuous operation. Reciprocating cutter at center meshes with gear in workholder, and turns burrs to one side. Stationary cutter in workholder cuts off burrs

other gear, advance and lock the fixture in mesh, index, and so on. This refinement has not been necessary on the work that we are doing as quantities are not large enough. It is covered in the machine patents*, however, and can be arranged readily if it ever seems economical to do so.

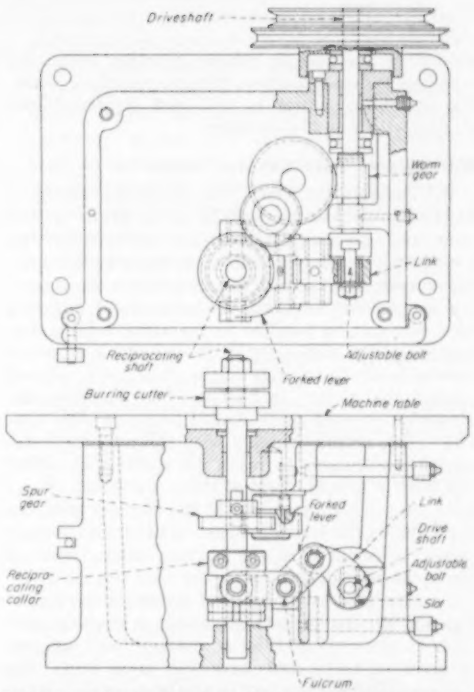
Machines presently in operation take gears up to 2 in. in diameter, but can handle much larger diameters, if special workholders are provided. Gear face widths run from 1/16 to 1 in. and gears of any pitch can be burred. Most of our work falls in the range from 56 to 24 pitch.

Cutters Have No Clearance

Burring cutters are made without clearance and with the same tooth lengths as the cutters that generate the gears. The work thus bottoms in the cutter and no stock can be removed from the sides of the teeth. Burring cutters are of simple design and anyone with equipment to cut gears can make them.

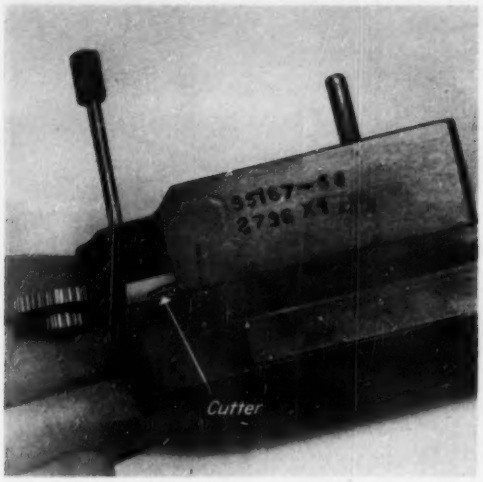
To produce the cutter that is used most frequently, two blanks are held together by screws and dowels. The blanks are cut together, then dismantled and hardened. After their meeting faces are ground, they are reassembled with a 1/32-in.-thick spacer that establishes the gap between the two cutter sections. This gap must be less than the face width of the gear to insure the gear and cutter remaining in mesh during the burring operation. When the cutting edges become dull, the cutter sections are dismantled, turned over, and reassembled. Double life thus is obtained before regrinding is necessary.

In some cases, gear shaper cutters that have been ground down too thin for gear cutting can be applied as burring cutters. The cutter in the second photograph is one of this type. When this is done, the cutter normally is annealed and recut without clearance. However, on hardened gears that have been

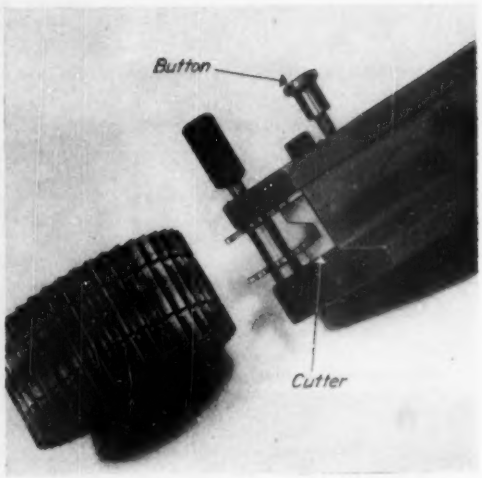


Driving mechanism produces both reciprocating and rotary motion in shaft on which burring cutter is mounted. Worm on driveshaft transmits power through gear train to spur gear on burring shaft. Forked lever produces reciprocating motion by acting against projections of disk under collar rigidly attached to burring shaft. Link causes forked lever to pivot about fulcrum. Reciprocation is adjusted by changing position of bolt in slot in head of driveshaft

* *U. S. Patent 2,441,078*



Stepped gear requires special workholder to cut burr from top surface of small-diameter gear. Mounting stud is withdrawn and gear is held out of burring position so cutting tool can be seen



Double gear is burred on two surfaces simultaneously by two-step cutter held against gear by spring pressure. Operator presses button to hold cutter down out of contact until gear meshes grooved reciprocating cutter

ground on the side to remove grinding burrs, we have used shaper cutters without recutting them. The stationary cutter is drill rod, hardened and ground with 2 or 3° clearance.

Workholders Take Several Gears

Workholders in which the stationary cutter is mounted often can be used for many gears. As the cutter position is adjustable in the holder and as the holder moves freely in the table slide, each holder accommodates a range of gear diameters. By changing the holder mounting studs, gears of different bore also can be handled in the same holder. For spur gears the stationary cutter usually is mounted vertically above the side of the gear and is pressed against the surface to be burred by the operator. However, stepped gears, double gears, or other special types, require holders with sliding cutters designed particularly to reach the surfaces on which the burr is turned. Two of these are shown in accompanying photographs. On the stepped gear, the top edge of the burring cutter is used, and a short stroke is required so the burring cutter does not leave the face of the gear.

Another interesting job, not shown, is the simultaneous burring of both pinions in a stepped gear. These pinions are of different diameter and different number of teeth, but have the same pitch. The reciprocating burring tool in this case consists of one cutter that drives the stepped gear, a collar, and a second cutter that is freely rotating and is driven by the second step of the gear during burring.

Internal ring gears are burred in special workholders in which the gear is free to rotate. The reciprocating burring tool is made to the same diameter and number of teeth as the original work cutter; otherwise it is the same as other burring cutters. In operation, the gear to be burred is placed in the workholder, a cover plate holding the burring blade is closed, the work is lowered over the reciprocating burring cutter, and the part is burred in the same way a spur gear is burred.

Changeover Is Easy

Actually, nearly 100 different holders and burring cutters have been devised to adapt this method of burring to the many varieties of precision gears found in Monroe's extensive line of calculating, listing, and business machines. Because of this variety and also because many gears are ordered in small quantities, the burring machine has been designed for maximum flexibility in the range of work it can do and for quick changeover from one gear to another. Changing the rotating cutter requires removal of only one nut on the reciprocating shaft; changing the stroke is a simple adjustment on an eccentric; and changing a workholder usually means only sliding it from the table guides. Guides are removable, however, and if it is desirable to make a workholder of special shape, guides can be changed accordingly to suit.

The machines have been in operation steadily for several years and results have been excellent. Burring costs have been reduced and the job now is much easier for the operator. At the same time, quality is improved in two ways: First, only burrs are removed—gear characteristics are in no way affected by the operation; second, a consistently good job of burr removal is done. Tool costs are low, maintenance practically negligible, and a wide range of gears can be handled with only a short time required for setup.

How to *Stop That Waste* in Machining

WE in Metalworking pride ourselves on our efficiency. Yet if we will examine carefully some of the things we do, we will find ourselves woefully wasteful.

Machining techniques are a case in point. The waste there is colossal. The editors of AMERICAN MACHINIST became convinced of that fact some time ago and decided to take a careful look at machining practices.

The approach to the problem was to see what is being done to take advantage of higher productivity now available in postwar-designed equipment; to compare what can be achieved with today's machines as against those of a decade ago; to find out to what extent companies are using higher feeds and speeds or are exploring their possibilities.

We discovered plenty. Most shocking revelation of all—the nation's metalworking industries are spending at least one billion dollars a year more than they should for labor costs alone, this total being based on figures taken from American Machinist's Mid-Century Inventory of Metalworking Equipment. That is one billion dollars wasted.

Why this waste? Because most machining is done on older types of machines which are only two-thirds as productive as postwar machine tools.

Proof of the huge labor cost which Metalworking is pouring down the drain every year is presented on succeeding pages. The facts and figures turned up are the result of a survey made by AMERICAN MACHINIST among machine-tool builders. Eye-bulging examples of what can be done to save that extra billion dollars a year are cited.

What's more, machining's various main divisions —turning, milling, drilling and boring, planing and shaping, grinding—are looked at one by one. Obvious savings in each category are pointed out.

But the editors have not stopped there. We have gathered in the following pages, for benefit of the timid, the exhilarating conclusions of those who have had the courage to try higher speeds and feeds and to experiment with new tool materials and with the capabilities of new machines. The emphasis here, as contrasted with previous articles on the same subject, is on drilling.

The material presented to you in this 2-part Special Report has never before been published anywhere. It has been assembled by personal visits to metalworking companies and by extensive research by E. J. Tangerman, managing editor. He tells HOW TO STOP THAT WASTE IN MACHINING.

An earlier article on the advantages of modern equipment was, "Do Machine Tools Cost Too Much?", in AMERICAN MACHINIST for Sept. 8, 1949.

Earlier articles in AMERICAN MACHINIST on high-speed machining include:
"Are We Slowpokes at Machining?"—Dec. 29, 1949.
"Are Shop Men Scared of High-Speed Machining?"—March 6, 1950.
"Three-Company Study Develops New Hobbing Technique"—March 6, 1950.
"HSS, Plus High Angles, Mills Like Carbide"—April 3, 1950.

I suggest that you read the entire series and study the possible applications in your plant, as a means of increasing production and of cutting costs.

Burnham Finney

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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Are We Riding the Brake

Indications are that a shift to the accelerator would cut time and cost, improve finish and increase tool life. Here are further reports of shopmen who are heading the parade — particularly in drilling — and reports of practical research here and abroad. Are we "chicken" about new tool materials and new machines?

BY E. J. TANGERMAN, MANAGING EDITOR

"MOST of the people with whom I have discussed high-speed machining do not seem to comprehend the possibilities of obtaining satisfactory results without going to something radically different, such as utilizing supersonic vibrations or hot-spot machining. However, I will tell anyone who will listen that *by using a sufficiently rigid machine tool with the necessary feeds and speeds, a super-speed broaching effect can be obtained with a multiple-tooth milling cutter.* Feed and tooth spacing must, of course, be uniform, and every tooth must cut a chip. Actually this was being done in some plants in Germany, where speeds of 700, 800, and 900 sfpm were specified as routine,* and experiments were being conducted at much higher speeds. Advantages were not only more finished parts between tool grinds, but also considerable reduction in horsepower requirements."

So writes a former Naval officer, who checked reports of interrogators of German ordnance engineers after World War II. He now sells machine tools, so he knows what he's talking about. He goes on to say: "Many American manufacturers argue that the actual time consumed in removing metal cannot be improved sufficiently to warrant spending effort on it, because the handling time consumes the largest share of the actual production time on a finished part. Even assuming that this is completely true, which it isn't, there should still be sufficient reason for investigating these higher speeds to take care of longer tool life and cut power requirements."

There is no question of the importance of providing adequate mechanized feeding and ejecting devices, supply hoppers, fast operating fixtures and similar devices to cut handling time to the bone. Arrangement of tool slides, toolposts, operating levers and handwheels must suit the job. Quick-acting tools and feed changes (including, pre-selection) are important. *But the fact is, as any shopman will admit if pushed, that we're doing nothing like optimum operating of our present equipment, partly through timidity, partly through lack of knowledge.* Rare indeed is the shopman who dares risk an expensive machine tool and its tooling to test a substantially higher speed. Yet increased cutting speeds, paradoxically, will permit the building of lighter machine tools with the horsepower capacity of present units. This can ,in turn, cut costs, reduce transportation charges, and export duties, and often give improved surface finish as a result of disappearance of the builtup edge. (And that, in turn, means reduced or eliminated second-operation costs.)

Coolant A Problem

It is fairly commonly understood that a cutting fluid normally fulfills two functions, lubrication and cooling. At low cutting speeds, particularly of tough, stringy and abrasive materials, lubricity is important to cut friction. But at higher speeds, cooling action becomes the more important, and water is the most effective coolant (highest specific heat) of any known. But water must be inhibited to prevent corrosion, contamination, etc. Hence the water emulsions and solutions.

Color No Criterion

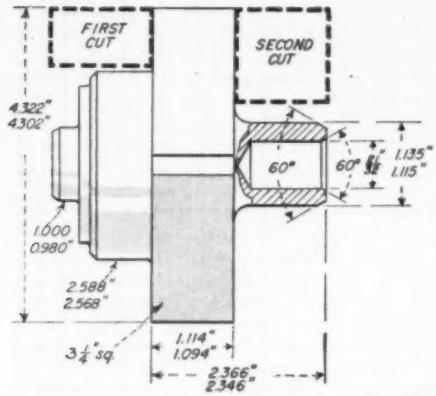
However, even these water-base cutting fluids, used in a recent series of tests in machining annealed SAE 1015 steel[1], were found to be decreasingly effective in reducing temperature at the chip-tool interface with increasing depth of cut and increasing cutting speed. In fact, they had no effect at all when the cut was 0.0052 in. deep or deeper at 400 sfpm, or 0.0104 in. deep or deeper at 200 sfpm. The same tests disproved another hallowed belief—that color in the chip indicates optimum cutting. *Different chip-temper colors were obtained with different cutting conditions even though chip-tool interface temperatures remained the same.* Again, water turned out to be better than carbon tetrachloride at lowering tool temperature at higher speeds.

Before we leave coolants, it may be interesting to note these further points: Particularly in precision grinding, coolants have been refrigerated to increase their heat-removal characteristics. In one case, a thin-walled cylinder was packed with solid CO_2 and turned in a lathe. Even at speeds much greater than those possible with the best coolants, the chip came off

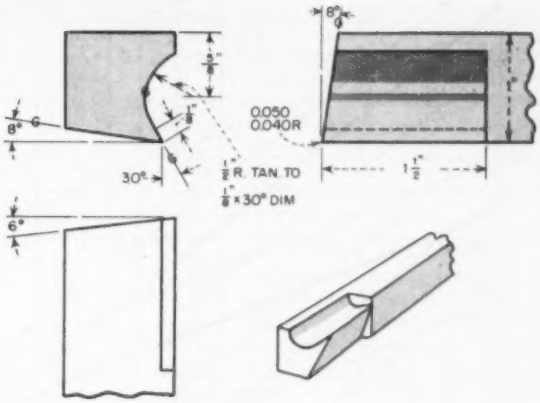
*German engineers believed that number of teeth should be *increased* as speed is increased, in contrast to American ideas.

[1] *"Effect of Cutting Fluid on Chip-Tool Interface Temperature", Shaw, Pigott, & Richardson, ASME, June, 1950*

In Machining Speeds?



1 **Tough Turning**—This hydraulic head, of Nitralloy G, required five passes with carbide to produce the necked portion, then broke down the tool in an hour. Apparently the aluminum in this Al-Cr-Ni alloy cuts clean until the sharp edge is worn from the tool, then it work-hardens directly ahead of the toolbit. Interrupted cut at the start caused rapid tool wear



2 **Nitralloy Nemesis**—This highrake tool of "Congo" (in the M-6 group) tungsten-molybdenum-cobalt superHSS solved the hydraulic-headturning job. With 0.004-ipr feed, 1⅛-in. depth of cut across corners and 90-sfpm speed, this tool operated for 16 hr and showed no visible wear. If the piece could be gripped securely, a deeper cut could be taken. Cutting took 50% less power than with conventional carbide tools. Added height at back curls chips for easy disposal. This SHSS must be very exactly heat-treated to R_c 64-66

cold and the tool stayed sharp — proving again that at higher speeds cooling is more important than lubricity. Also, one company is reported to be using liquid CO_2 as a coolant. This becomes a "snow" on the work, then evaporates, absorbing tremendous amounts of heat in the process. Work must be hooded to exhaust gas, of course..

Again, back in 1914, *American Machinist* (Vol. XL, page 61) reported that steam lubrication was being used in cooling milling cutters, and that speeds ran as high as 835 sfpm. We seem to have slipped backward since then. J. Finlay, general manager of the Australian Government Small Arms Factories, writes that they had considerable success with the method, even though they had to borrow a coolant tank from a big grinder to get sufficient flow, and they had to hood every job. He's going to try it again as soon as he runs into sufficiently large production to make it sensible.

Mr. Finlay also says that twelve years ago, E. W. Field, then head of H. W. Ward & Co., Birmingham, England, maker of turret lathes, said that *his first step, when trouble was encountered with carbide, was to increase the cutting speed, which usually cured the trouble.* An American maker of special water solution coolant tells me that his standard procedure in a new application is to step up speed first. Then, as the chip works down to the tool tip, he increases feed, continuing this alternation until the new optimum is reached.

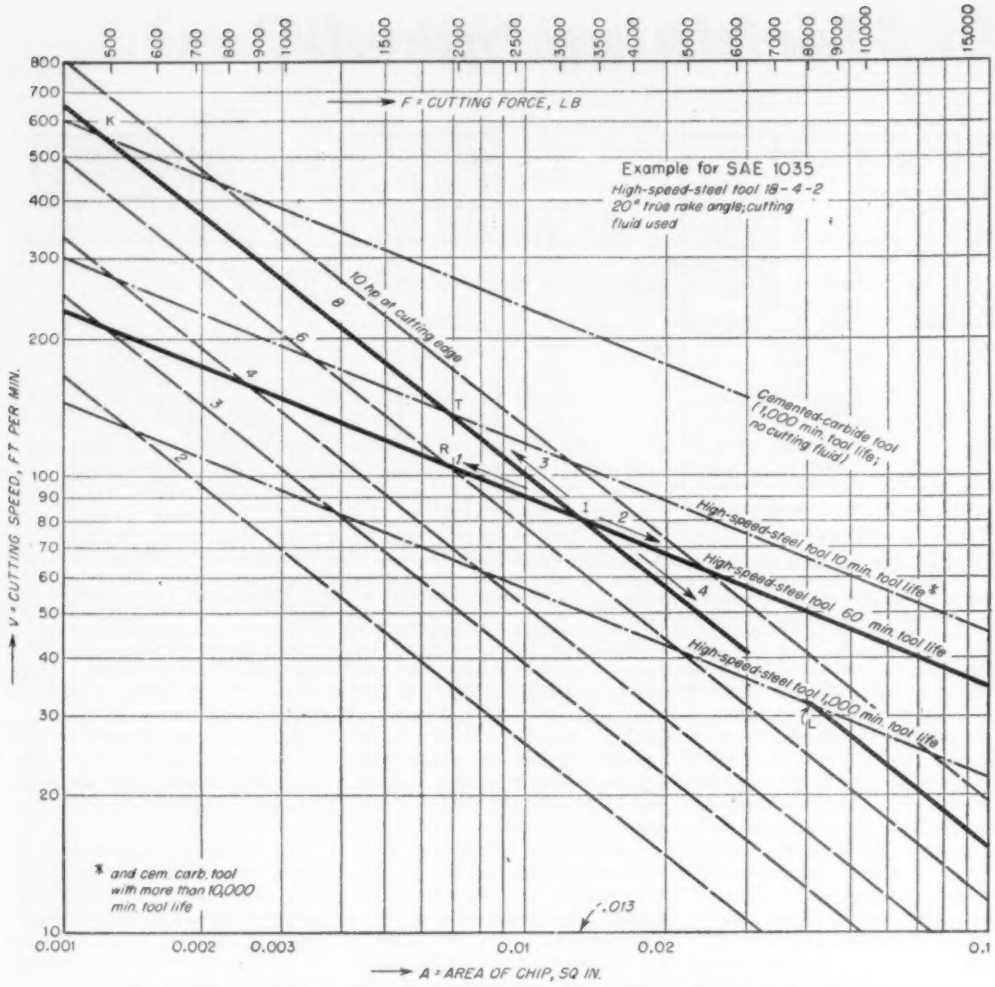
Optimums Not Attained

That optimums have not been achieved in machining can be brought out by several cases in point. One is the article by Walden Sinawski (*AM*, April 3), showing tremendous improvement in milling speeds with high-angle cutters of T-15 super-HSS. A parallel example in high-angle turning is shown in Figs. 1 and 2, on the Nitralloy pump-head job. Here, in addition to increased speed, tool life is at least 16 times as long, finish is improved and machine power is reduced — all with a less-costly tool. When, after 16 hr, width of cut was increased to 1½ in., the work slipped out of the chuck and smashed into the tool. This merely dented the edge, instead of crushing or breaking it.

Lees-Bradner has developed a hobber with 1800-rpm spindle to drive National Tool hobs with wedged carbide inserts (*AM*, Mar. 6, p. 96). Planned spindle speeds of 550 to 600 rpm were tripled without the necessity for basic machine changes. Aluminum and plastic are now hobbed at such speeds. Fine-grain CI change gears are being climb-hobbed at 450 rpm with a 4-in. dia, 10-gash hob at 0.060 ipr feed and improved accuracy. This is 450 fpm compared with 90 fpm and 0.050-ipr feed with a 3-in. steel hob, and 15 times the pieces between grinds.

These companies report no more maintenance, skill, or art is required to operate at the higher speeds, are now sure that high-speed carbide hobbing of steel gears is feasible.

Another indication is the report from Detroit that speeds of machining lines and of special trans-


F = CUTTING FORCE, LB
V = CUTTING SPEED, FT PER MIN.
A = AREA OF CHIP, SQ IN.
Example for SAE 1035
High-speed-steel tool 18-4-2
20° true rake angle; cutting fluid used
10 hp at cutting edge
Cemented-carbide tool (1,000 min. tool life; no cutting fluid)
High-speed-steel tool 10 min. tool life *
High-speed-steel tool 60 min. tool life
High-speed-steel tool 1,000 min. tool life
* and cem. carb. tool with more than 10,000 min. tool life
.013

3 Productivity Diagram—Developed in 1940, this diagram is considered basic for machining with single-point tools. It helps in selecting the most effective combination of cutting variables. Selection of and changes in cutting speed as a function of chip cross-sectional area should be made along the "machine" (steeper pitch) line, not along the "tool" line. The tool should be adapted to the speed pre-selected, using a higher-quality tool if necessary, particularly if the work is unstable and higher finish is desired

fer or shuttle machines are currently limited by permissible drilling speeds—just as in automatic lathes and screw machines. As a consequence, several makers are rushing high-speed drilling machines for cast iron, using special heavy-duty carbide drills. One maker is reported to have reached a feed of 1 in. per sec—practically punching — with a ½-in. dia carbide drill. It of course had coolant-feed holes, and 15° helix. Also, at least four sources are studying high-speed drilling of cast iron, and at least two the question of proper type and amount of clearance behind the cutting edge.

One lab is currently running some milling tests on bearing steel at 5000 fpm; a user has requested a quote on a large machine tool with 20 times currently available feed. A maker of carbide slitting saws reports surface speeds from 150 to 5000 fpm, and feeds from 2 to 300 ipm, with chip loads as high as 0.010 in. per tooth. One automotive manufacturer has set up an SAE 1010 or 1020 job on a boring machine at 1600 sfpm, with 1/32-in. cut, another has increased power of a 15-year-old LeBlond lathe from 15 to 40 hp and is turning steering knuckles at 1400 sfpm.

Along the same line, Prof. K. V. Olsen of the Machine Tool Laboratory, Royal Technical University, Copenhagen, has this to

say about my statement, "Chip load can and should be maintained when speed is increased" (*AM*, Mar. 6): "Chip load will decrease continuously from about 150 sfpm to approximately 800 sfpm, then will remain constant. This is for plain carbon steel, but for cast iron I find almost the same picture. I have investigated cutting speeds as high as 2100 sfpm; at these high speeds tool life is shortened, and the cutting speed is thus limited by the tool wear. . . . I feel that industry should be able to speed up production by coordination of the recent advancement in workshop practice and the latest scientific investigations carried out by laboratories, research departments, technical universities, or the like."

Productivity Diagram

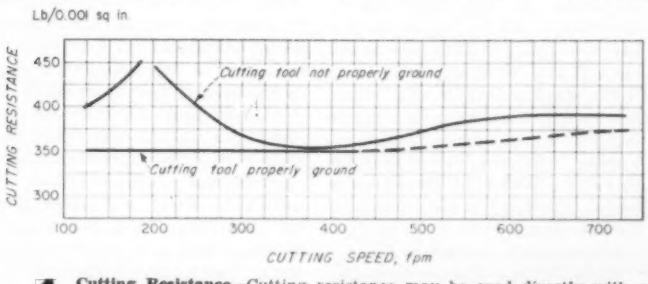
Dr. M. Kronenberg indicated about ten years ago[2], that two different relationships exist between chip cross-sectional area (or cutting force) and cutting speed. They can be represented in one "productivity diagram" (Fig. 3), from which basic principles governing single-point machining can be derived. He concluded from these principles that selection of cutting speeds in relation to cutting force, as determined by chip-cross-sectional area, should be made in accordance with horsepower capacity of the machine (machine line).

Increasing the speed according to the machine line rather than according to the tool line can be accomplished by the use of higher grades of cutting tools. It is advisable when the workpiece is unstable and/or if a high surface finish is desired. On the other hand, it is advisable to decrease speed and increase chip cross-sectional area (depth of cut by feed) according to the machine line in roughing big workpieces.

Recently, several shopmen have suggested an interesting theory with regard to the effect of temperature at the cutting tip. One goes so far as to say that all machining is simply a chemical reaction involving heat and pressure — as one goes up, the other can go down. You are probably familiar, at least in principle, with friction sawing and the much greater cutting speeds obtained by that process with saws that are, in effect, toothless. Recent theory states that the friction of the saw blade creates a sufficiently high temperature at the cutting edge so that the metal loses its tensile strength, then is swept away in globules by the saw, or more probably, by the air envelope enclosing it. The metal does not burn or melt, but approaches melting temperature sufficiently closely so its tensile strength is lost. Can this happen also in the path of a high-speed cutting tool?

Because heat and specific cutting force are so closely interrelated (see Dr. M. Kronenberg, *AM*, Sept. 22, 1949), there is some support for the theory that work-hardening capacity of a material is reduced at certain cutting speeds. While changes in work-hardening capacity are not known to affect the structural use of metals, they have a marked effect on their resistance to deformation such as occurs in metal-cutting operations. Cutting resistance can be read directly from the dial of the Schlesinger Machinability Tester (*AM*, Nov. 21, 1940), as shown by the curves of Fig. 4, obtained in tests run at Kennamental during investigations of effect of increasing cutting speed on cutting resistance. In this manner it is possible also to investigate the effect of incorrectly ground tools with regard to changes in cutting resistance as cutting speeds are increased.

[2] *"Machining with Single-point Tools", Tool Engineer, Jan., Feb., 1940*



4 **Cutting Resistance**—Cutting resistance may be read directly with a machinability tester, as indicated by these tests run at Kennametal. The material in this case was AISI 8640HR, with a Schlesinger abrasion factor of 1.08. Feed was 0.016 ipr, depth of cut 0.0625 in.

Where Heat Goes

Research some years ago by Dr. Kronenberg indicated that *60 to 75% of the heat generated in cutting was carried away by the chip.* In dry-cutting cast iron, for example, ten tests gave an average of 70% of the heat carried away by the chip, so that only 30% went into the work and/or the tool. In dry-cutting chrome-nickel steel, the range was from 69% at 60 fpm to 75% at 180 fpm, indicating increased heat in the chips at the higher speed. Trigger and Chao[3] say that the *proportion of the "interface" heat going to the chip increases with an increase in cutting speed.* Variation is from about 68% at 100 sfpm to 94.5% at 600.

This gives rise to a number of interesting conjectures. For one, *the apparent mean tool-tip temperature ranges from 1030 F at 100 sfpm to 1502 F at 600 sfpm in turning (Holm[4] estimated maximum temperature on high spots of chips as 2.7 times this), while chip temperature (leaving the shear zone) drops from 940 F at 100 sfpm to 696 F at 600 sfpm.* With such temperatures available, are we not approaching the conditions which exist in friction sawing — namely that the tensile strength of the material is reduced so greatly that chip removal becomes easier? This would account for reduced horsepower requirements, noted by William Coomey in his tests at Rice-Barton (See *AM*, Mar. 6), and would be borne out by numerous tests. But there is, at the same time, danger that the tool will break down, for hardness number of car-

[3] *"An Analytical Evaluation of Metal-Cutting Temperatures", by K. J. Trigger and B. T. Chao, Univ. of Ill.*
[4] *Jnl. of Applied Physics, Vol. 19, 1948, p. 361*

bide decreases above about 1500 F, so wear of the tool through chip friction will rapidly increase. Cratering will also occur, acording to Prof. Olsen. He believes the problem, therefore, is to find the optimum point at which cutting speed and tool life are at their best. He feels this zone is narrow, and attaining it in each case requires a steplessly variable-speed drive.

An increase in cutting speed results in a decrease in both horizontal and vertical components of cutting force — which Ernst and Merchant observed almost a decade ago. Trigger and Chao[3] point out that an increase in cutting speed from 100 to 600 sfpm cuts the vertical force about 25%, the thrust force more than 50%, while friction force is also reduced about 50%.

Again, if the temperature is so high at the tool tip, does so-called "hot-spot" machining (J. E. Armitage & A. O. Schmidt, *AM*, Feb. 10, 1949) offer any long-term potential for normal machinable materials? Why add heat to an area when it can be created at the cutting tip?

Here, at least, is a preliminary answer: The "hot-spot" machining process seems to permit control of temperature and heat input, while friction cutting does not. Heat in cutting is, however, not only a result of friction between chip and tool face and flank, but also to a considerable extent a result of destruction of molecular cohesion in the work material (Kronenberg, *AM*, Sept. 22, 1949). This physical process is similar to that which occurs when atomic cohesion is destroyed to release energy (heat). The greater the resistance to destruction, the greater the generated heat, as we proved at Hiroshima.

On the other hand, when heat is supplied to the work from an outside source, as by induction or flame, the resistance to destruction is reduced and the cutting operation eased, just as heating a steel plate reduces its work-hardening capacity and resistance to deformation in a power press.

When high cutting speeds may cause substantial centrifugal forces in machining a heavy workpiece, hot-spot machining may be (and has been) used as an alternative, just as it is now used to make "unmachinable" materials machinable.

Again, friction at the tool face rises in importance as cutting speed goes up, deformation at the shear zone declines, so the shape and condition of the face would appear to assume increasing importance in holding temperature down at higher speeds[3]. This is borne out by Mr. Coomey's tests.

What of Drilling and Reaming?

Because of small diameters normally involved (70% of tapping, for example, is in sizes of ½-in. or less) drilling, reaming, tapping and threading are rarely done at high surface speeds, even though carbide tools may be used. H. Goldberg of Snow Mfg. Co. has held for years that tapping speeds are far too slow, principally because the same tap is used for all materials. Difficulties are experienced in holding size, and instead of stepping up speed, the tendency is to step down, which is wrong. Taps *can* operate at high speeds — given commonsense treatment. Why run a HSS tap at carbon-steel speeds?

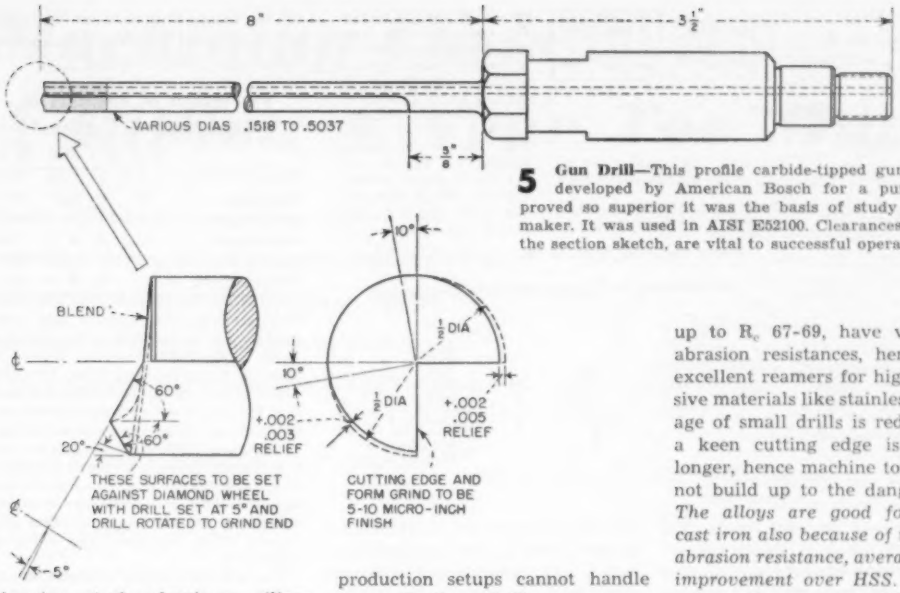
Recent threading cases bear out the same principle. With carbide chasers in a diehead, J & L has threaded ¾-in. X1315 bar at 2000 rpm, the turning speed, thus avoiding a change of spindle speed. This works out to about 390 sfpm. Hardinge, at the Tool Show, threaded a 7/16-in. stud on a zinc-base die casting at 3500 rpm, or 400 sfpm. And H. W. Ward, of England, is threading a 10⅝-in.-dia, 14-tpi component at 480 sfpm in a turret lathe. There are other similar examples, indicating that *carbides make it possible to thread on a screw machine, turret lathe, or similar production setup at the rotative speeds used in turning.*

Recently one electrical manufacturer announced that stepping the cutting edge of a drill rather than leaving it continuous permits much higher drilling speeds. This turns out to be notching either one or both cutting lips — the old "chip-breaker" grind set to formula. One automotive company has rediscovered somewhat the same thing — that changing the taper of the outer portion of the cutting lip (in effect, chamfering it and thus broadening the area exposed to maximum friction and heat) permits higher cutting speeds in cast iron. In each case, longer tool life is also reported.

Carbide Drills

Carbide drills are being used increasingly, but in most cases on specialized jobs, so publishable information is hard to come by. Users report "amazing" results — with good operators on good machines running carefully worked-out jobs. American Bosch worked out a carbide gun drill, Fig. 5, that permits unusually high surface speeds. **This drill**, and modifications, made by Eldorado Tool & Mfg. Co., Milford, Conn., **drilled in one case at 1190 sfpm in steel** (compared with recommended top of 390). Some drills have carbide tips and carbide wear strips, others have solid carbide ends. Only Hastelloy and some other high-temperature alloys give trouble.

In addition to the familiar setup with drill turning, jobs have been run with work turning, or with both drill and work turning. Drilling has been done at speeds from 1500 to 6400 rpm, and 10,000 rpm is planned. Feeds range from 0.0002 to 0.0035 ipr. Among current jobs are these: A 1⅝-in. hole drilled in 14 ST aluminum at 0.0015-in. feed and 800 rpm (340 sfpm), with finish so good three or four finishing operations have been abandoned. A 1¼-in. hole in Nitralloy 13 in. deep. A roughly ⅜-in. hole drilled 25 in. deep in steel with feed of 7 ipm and 400 holes per grind, 1700 per tool (would be higher except for breakage through operator error). A hole 8 in. deep in steel at 6000 rpm. An 0.4545-in. hole at 22 ipm in nickel cast iron and 17 ipm in B1113 steel — the machine limit, not the drill limit. Other materials drilled: chrome-moly steels; 303, 304, and 316 stainless; Timken



5 **Gun Drill**—This profile carbide-tipped gun drill was developed by American Bosch for a pump barrel, proved so superior it was the basis of study by a drill maker. It was used in AISI E52100. Clearances, shown in the section sketch, are vital to successful operation

bearing steel; aluminum silicon bronze; beryllium copper; metallized graphite.

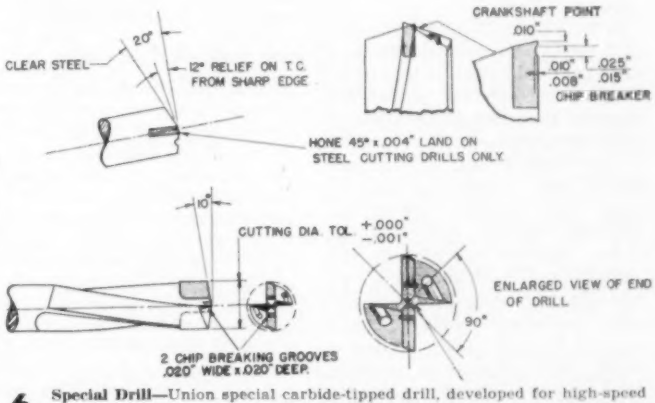
In drilling, the most important element is the care with which the drill is made; a good drill will work in a sloppy machine. Nose angles must balance transverse loads on the cutting edge so the critical outside corners will run true. If the drill cuts oversize it will chatter; if undersize it will rub and pick up, breaking out pieces of carbide. The guide bushing must fit very closely —not over 0.0005-in. clearance. If the drill doesn't start its own size, it will never reach it.

Nose angles must be longer for softer materials. The problem is to clear the chips. A V-shaped chip is cut, which should break apart at the V as well as into short lengths. Relief angles are as low as 1½ to 2°. Drills are made with slight back taper, but enough that starting bushings must be changed as drill is used up on accurate work.

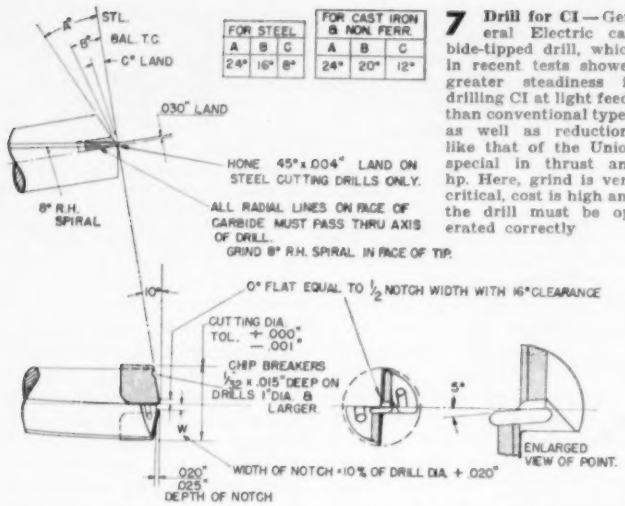
Coolants are usually high-load-carrying oils, some sulfurized lard oil, some with free sulfur. It is essential that the coolant resist any film interruption; if chip backbone builds up and pushes through the oil film, for example, there'll be trouble.

Many drilling machines are not beefy enough for carbides and some production setups cannot handle them. Further, drills or reamers must have strength and toughness and yet hold an edge. In these cases, the super-high-speed steels may prove to be an answer. Union Twist Drill, for example, has developed drills and reamers in T-15, M-3 and M-4 alloys that give double to ten times the production of ordinary HSS. There are high-carbon, high-vanadium, HS steels (see table), very hard and very tough. Such tools, with hardnesses up to R_c 67-69, have very high abrasion resistances, hence make excellent reamers for highly abrasive materials like stainless. Breakage of small drills is reduced and a keen cutting edge is retained longer, hence machine torque does not build up to the danger point. *The alloys are good for cutting cast iron also because of their high abrasion resistance, averaging 50% improvement over HSS.*

In most cases, super-HSS can be stepped up 30% in speed for initial tests, providing chip load is increased sufficiently to be held constant. In drilling stainless, for example, 25 or 30 fpm with 0.003 to 0.004 in. per rev is a good starting point. Feed must be positive—in other words, automatic—rather than hand, or varying loads will break the tool. On aluminum, by contrast, there seem to be no limits, unless deep holes are drilled. Then



6 **Special Drill**—Union special carbide-tipped drill, developed for high-speed drilling of steel in New Britain automatic lathes, has been used on cast steel as well, where tensile strength is high and the low speeds at the tip would cause standard carbide drills to crumble at the chisel point. Modification of point design cuts hp per cu in. per min. 20%, thrust 35% over standard design, even in heavy-duty, long types, but cost is high and grind is critical


FOR STEEL
A B C
24° 16° 8°
FOR CAST IRON & NON FERR.
A B C
24° 20° 12°
STL.
BAL. T.C.
C° LAND
.030" LAND
HONE 45° x .004" LAND ON STEEL CUTTING DRILLS ONLY.
8° R.H. SPIRAL
ALL RADIAL LINES ON FACE OF CARBIDE MUST PASS THRU AXIS OF DRILL.
GRIND 8° R.H. SPIRAL IN FACE OF TIP.
10°
0° FLAT EQUAL TO 1/2 NOTCH WIDTH WITH 16° CLEARANCE
CUTTING DIA. TOL. + .000" — .001"
CHIP BREAKERS 1/32 x .015" DEEP ON DRILLS 1" DIA. & LARGER
W
5°
ENLARGED VIEW OF POINT.
WIDTH OF NOTCH ±10% OF DRILL DIA. + .020"
.020" .025" DEPTH OF NOTCH

7 Drill for CI—General Electric carbide-tipped drill, which in recent tests showed greater steadiness in drilling CI at light feeds than conventional types, as well as reductions like that of the Union special in thrust and hp. Here, grind is very critical, cost is high and the drill must be operated correctly

speed should be held down, but feed increased. This lets the coolant to the cutting lips, prevents plastic flow of the material, and avoids tearing. The same principle holds true in deep drilling of brass.

Here are some typical recent jobs with super-HSS tools:

In drilling 17/32-in. holes in a lathe bed, speed was stepped up 30% with T-15, feed increased to 0.011 ipr, giving a total improvement of 9 to 1 over HSS.

In drilling a 29/64-in. hole in 52100 (1.1-1.2 C, 1 Cr) bearing steel, a cobalt drill produced 45 holes, then went oversize. A T-15 drill, after 135 holes, was still exactly on size.

A T-15 dovetail cutter showed 2 to 1 improvement over HSS in a very hard alloy steel turbine body.

An M-4 cutter has proved far superior in cutting highly abrasive graphite bronze.

T-15 hobs in one of the auto plants have halved regrinds, in other cases permit roughing and finishing without hob regrinds.

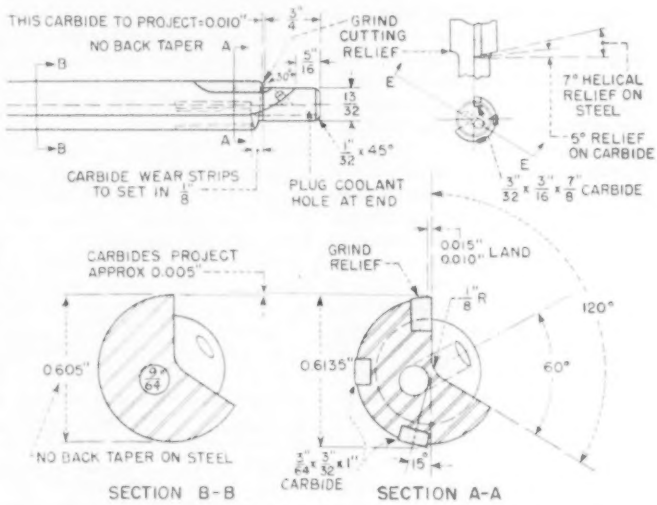
The qualities which make the super alloys outstanding in tool life and performance also complicate regrinding because of the ease of burning. They require a rigid, well-maintained grinder, solid holding of work (with steady-rest on cylindrical work), large wheels to compensate for rapid wear, and wheels one or two grades softer than for HSS to insure free cutting. Wheels should be rough-dressed with a sharp, conical diamond. Aluminum-oxide wheels work best in most cases. Heavy roughing downfeeds (0.0005 to 0.002 in. per pass) and one light finishing pass with a freshly dressed wheel seems to work best. Avoid many light passes. On HSS with 3½% or more vanadium, wheel speeds of 3000 sfpm require 50% less power and cut the danger of burning—one case in which a surface speed *below* the accepted optimum proves advisable.

Percentage of Elements in Typical Super-HSS Alloys*

	T-15	M-3	M-4	M-6
Carbon	1.5	1	1.25	0.78
Tungsten	13	6	5.5	4
Chromium	5	4	4	4
Vanadium	5	3	4	1.4
Cobalt	5	—	—	12
Molybdenum	—	6	5	5

* "Super high-speed steel" has been used loosely in industry in the past few years to designate anything higher in alloying elements than HSS. Actually, SHSS should properly be the designation for alloys with extra abrasion resistance and initial hardness above that of ordinary HSS—in other words, carbon content is above 1.0% and considerable vanadium is added to absorb this added carbon and form the complex vanadium carbides that produce the higher initial hardness and abrasion resistance.

There is an entirely different family of cobalt steels which do *not* have higher initial hardness than ordinary HSS—in fact, may have a lower hardness, as do the cast alloys—but have much higher red hardness because of the high cobalt content. Thus, M-6 is a cobalt-moly steel. T-15 happens to be a combination of a SHSS and a cobalt steel (5% Co gives high red hardness in addition to the initial HSS hardness), thus is properly a SHS-cobalt steel.



8 For Tube Boring—Developed to bore rough-walled hot-rolled tubing in a screw machine, thus to avoid slower drilling of a solid bar, this New Britain tool delivered holes 4 in. deep and very straight (only 0.002 to 0.003 in. runout), gave good wear. The pilot has 1/32-in. clearance, directs the coolant jet to throw chips back, thus preventing fouling and scoring

Machining Costs A Billion A Year Too Much

Studies of productivity of postwar machine tools, including a just-completed survey by *American Machinist*, indicate that American Metalworking is wasting this huge amount each year in labor costs alone because it has not applied higher-productivity postwar equipment

BY E. J. TANGERMAN, MANAGING EDITOR

IF THE 1,700,00 machine tools of prewar type (built before 1946) in American plants operate only 40 hours a week for only 40 weeks out of the year, at a direct labor cost of only $1.25 per hour, the *labor cost alone on existing machine tools is almost a billion dollars a year too much.* This is because new postwar machine tools average 40% more productive—or put the other way: a 10-year-old machine tool averages only 71% as productive as a new one.

It is, of course, very difficult to generalize on equipment improvement and impossible to draw a statistical average. Machine-tool builders themselves have claimed a one-third increase in productivity, and the equipment engineer of one of America's largest plants set the average productivity increase realized from his postwar installations at fully 40%. We have just completed a survey which indicates that 40% is, if anything, conservative. But let's analyze the problem:

Since 1929, there have been three waves of redesign of machine tools that resulted in greatly increased productivity: one in 1933 to 1935; another in anticipation of the heavy demand to fill Europe's rearmament needs and our own defenses in 1938 and 1939; the third in 1945 to 1947, following World War II and preceding the 1947 Machine Tool Show. The effects of the first two were evident in our tremendous productivive capacity during the War, but that of the third is less readily assessable.

Hence, in mid-May, we addressed to machine-tool builders this question: "How much more can 1950 models of each of your standard lines produce in a given period than the 1940 models?" Some 60 companies replied, giving not only direct statistics, but also detailed discussions that proved far more interesting. These will be presented by type of machine; general points are below.

Says one prominent machine-tool builder: "Beyond any question of a doubt, our machines can produce work more rapidly than the actual output experienced in users' shops. In many instances, labor establishes the rate per hour from the machine. Briefly, some shops will produce only so many pieces per hour—and the owner is at a loss to improve his production."

Says another: "Ten years ago and better, we figured 85 to 90% efficiency from the man. Today we base our figures on 65 to 70%. This doesn't mean the machines won't do it, but it does mean that labor won't let us."

Still another recounts the case of a machine tool which in the South produced 15 times what it would in the North—*on the same job and in wartime.* If we enter a war now, will some elements of labor do the same thing again?

Local labor leaders, in particular, are major factors in preventing achievement of maximum productivity. Even with handling equipment, simplified or automatic control and other factors that make the operator principally a button pusher, there is still conscious, deliberate delaying and slowing.

Undoubtedly this is generated by

Machine Tools Have Made These Gains in Ten Years

1. Speed and feed ranges on many machines have been approximately doubled, usually to handle carbides.

2. Power available for metal removal is doubled or better, to take full advantage of latest cutting tools.

3. Controls have been simplified, grouped, and made more convenient, to reduce operator effort.

4. Tolerances are closer, so the machine tools work in turn to closer tolerances and better finishes, eliminating many second operations.

5. Many new standard and special attachments have been developed.

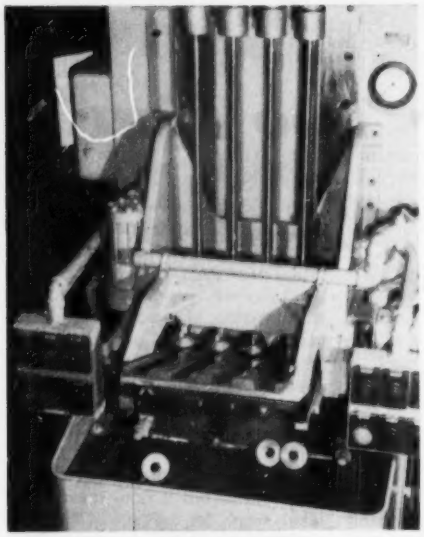
6. More careful study of methods and machining problems, to cut costs to the bone, has resulted in increased productivity from individual units.

7. New designs are more rugged, better lubricated, more carefully worked out, thus maintenance cost and downtime are reduced, accuracy and finish obtainable improved.

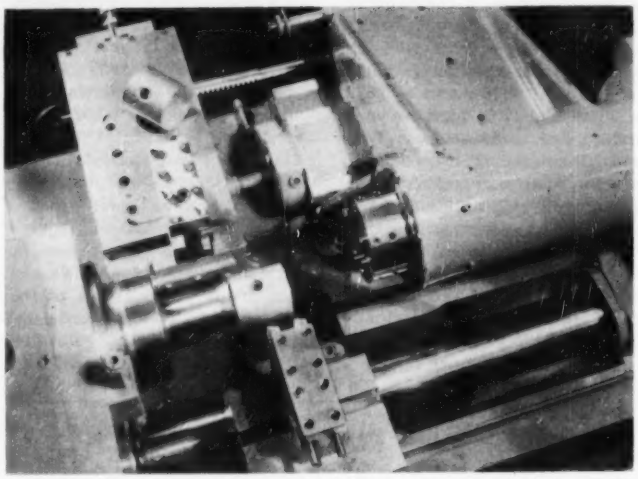
8. Automatic feeders, gaging and ejectors have been developed.

9. Multiple tooling and spindling and application of transfer mechanisms has reduced chucking or clamping time.

10. Materials to be machined have changed radically—they are harder, tougher, more abrasive. Today's machines can handle them because of their greater rigidity and power; older ones cannot.



64% More In Broaching . . Continuous automatic cycle, gravity chute feed, and an automatic hydraulic transfer slide are one answer in stepping up broaching. Here a 4-station unit so equipped is 64% more productive than the manually operated machine. The operator merely keeps the chutes filled, while broached parts slide forward by gravity. Previously, the operator had to pick up and place four parts over broach shanks, then start both strokes by pushbutton. Original production was 490 splined gear blanks per hour at 85% efficiency, now it is 804



New Under the Sun . . Ten years ago, there was no automatic lathe of this size that could start and stop ten times a minute and run at 2500 rpm. Here an aluminum piston is rough-turned, the skirt rough-faced and the head milled at the same time. Floor-to-floor time is 6 sec, three times faster than in 1940

the surface evidence that a new machine makes one man do what two or three did before. But more careful analysis proves that men so displaced are promptly absorbed elsewhere, plus others required in service or other capacities.

Turning

Among lathes, expected variations occur in productivity comparisons depending upon machine type and size. One toolroom lathe, for example, is considered 60% more productive than the 1940 unit, but the 1940 machine was a small, light-duty machine. Another more standard model is 25% more productive. A third is estimated at 30% higher production. A large manufacturer points out that he has doubled speeds on smaller units (25-in. swing and less), raised them slightly on larger ones, and increased horsepower 50%. But he has no general percentage of improvement in mind, because productivity of the toolroom lathe, more than that of any other machine tool, is directly a function of the operator's skill and speed.

On turret lathes, one hand-operated vertical type is now about 30 to 35% more productive than its 1940 predecessor. This percentage can be raised considerably if the operator and the job permit use of set stops and higher modern spindle speeds. If an indexing-control machine is applied to the same job, increases will be 300 to 400%, because cycle time is faster, checking and setting during the process is eliminated, and speeds are higher.

Another maker points out that motors on saddle-type turret lathes are now two to three times the size of those of ten years ago. Further, drives have been improved so speeds of 2500 rpm can be attained ten times a minute and a job can be done in a third of 1940 time.

A third maker of turret lathes estimates a 50% increase in productivity across the board, higher for smaller-size units, lower for larger ones.

Screw Machines

Productivity increases on automatic lathes and screw machines also vary widely. One maker of larger machines estimates 10% improvement, plus further increases where carbides can be used. Another, who has shifted from hand to automatic types, has stepped up productivity 50 to 100%. A third reports one case in which improvement was 500% because of improved tooling and a shift to carbides, a general improvement of 33% on steel, 100% on non-ferrous materials.

Here, as elsewhere, good tooling is vital. For example, one maker reports that an automotive master mechanic took a 15-year-old machine and re-engineered it for steering knuckles. He took out a 15-hp motor and the gearing and hooked up a 40-hp motor direct to the spindle. Addition of shielding to guard against flying chips—and flying work in case of center breakage—and similar changes have made it possible to attain 1200 to 1400 sfpm—because the old machine was exceptionally sturdy.

The same master mechanic bought a machine tool figured to produce 32 crankshaft counterweights per hour, is now turning out an average of 58, and has reached 71 with his own tooling.

Similar gains are reported on screw machines—a result of heavier motors (two or three times as large) and shifts to carbides where practical. One maker reports production increases of 30% on steel, 50% on brass, 60% up to 100% on aluminum.

Automatic work cycles will sometimes give productivity increases even though carbides cannot be used. For example, several makers of crankshaft lathes report little advance in productivity because the intermittent cuts reduce life-between-grinds on carbide tools and hold surface speeds down. However, one maker has achieved a 25 to 30% increase by combining roughing and finishing in the same machine. Formerly, the two operations took 5 min., 4 min. of it (or 80%) for chucking. Now rechucking is eliminated and finishing time cut to 9 sec, so floor-to-floor time is 3 min., 9 sec—reducing cycle time 37%.

A new car-wheel lathe, designed for carbides and equipped with a profiling attachment, has increased daily output from 8 to 15 wheel sets—or almost double.

Milling

Because millers are used both in toolroom and production work, comparative figures cover a wide range. One line of toolroom millers is estimated as 25% more productive than their prototypes of ten years ago, another line is 80% better—and cuts later operations because of greater accuracy. On production jobs, where carbide tooling can be used, standard millers average 10 to 20% in small sizes, 50 to 100% more productive on larger ones, while the big special jobs run 50 to 500% better, with the average above 100%. Here, transfer mechanisms, tracer controls, greater rigidity, better spindling (with counterweighting) and better fixturing have all played their part. Horsepower has, of course, been doubled in many cases. Three specific cases: output tripled, output doubled, one machine outpro-

HOW A BILLION A YEAR IS WASTED

HOW much does it cost to run an outmoded machine tool?

Well, recent studies indicate that cost per hour to run the average unit is $5 to $7, of which $1.25 to $1.50 is direct labor (current weekly earnings average over $60, indicating an hourly rate of $1.50). To be conservative, let's disregard other elements of cost than direct labor — such items as overhead, floor space, scrap percentage, and the like. Let's take 40 hours a week for 40 weeks a year as a very conservative average period, and the low of $1.25 as direct labor cost per hour.

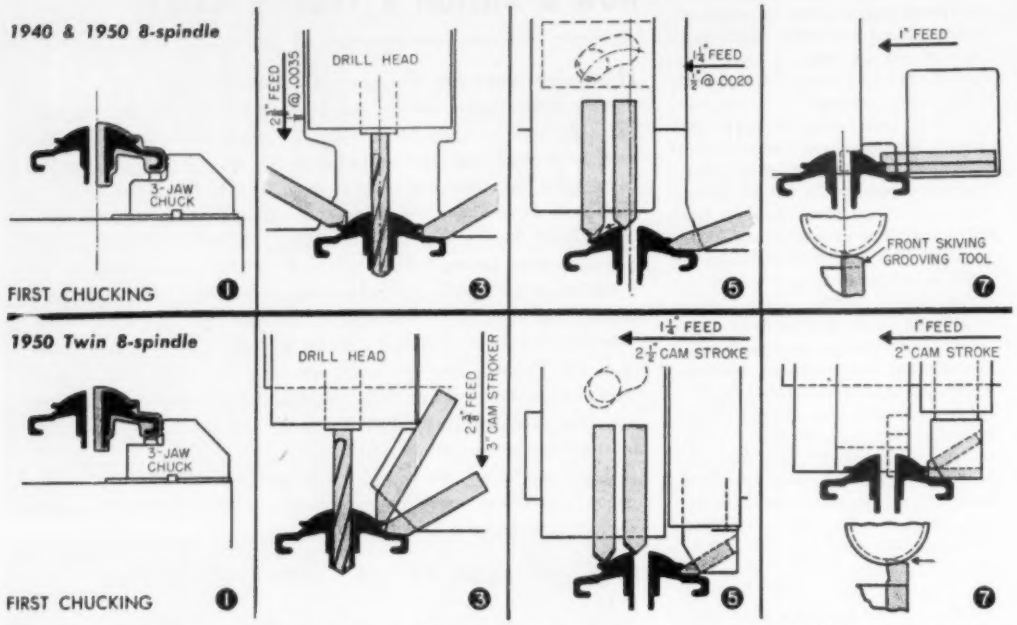
Metalworking, according to the American Machinist Mid-Century Inventory, has 1,762,000 machine tools, of which 95% are either more than ten years old or of designs that old. (Actually, 21% of the units are more than 20 years old.) This survey indicates that present-day machine tools average 40% more productive than their predecessors of a decade ago, also gives productivity-increase percentages, type by type, for units totaling 75% of the total.

From these factors, the annual cost to American Metalworking of the direct labor alone wasted on machine tools that cannot meet today's production standards is $969,000,000.

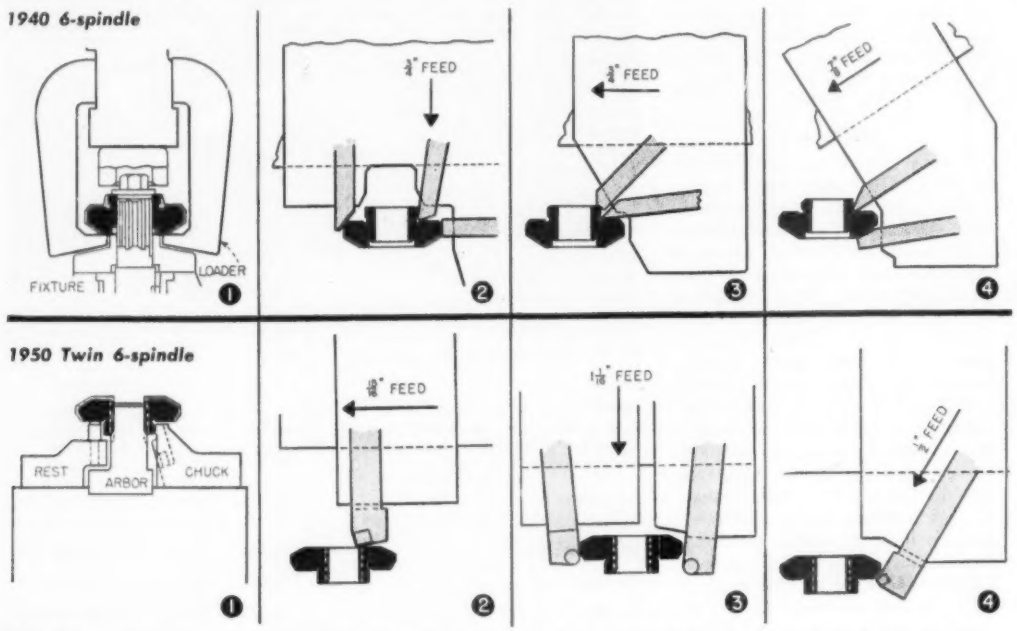
HERE ARE SOME TYPICAL APPARENT WASTES

MACHINE TOOL	UNITS AT LEAST 10 YEARS OLD IN DESIGN	% INCREASE IN MACHINE PRODUCTIVITY 1950 over 1940	WASTE, $
Boring Machines			
Horizontal	16,900	105	$17,700,000
Vertical, incl. vert. turret lathes	18,600	250	26,600,000
Jig boring	5,600	15	1,500,000
Broaching	12,300	100	12,300,000
Drilling			
Sensitive	72,800	40	41,700,000
Upright	190,000	25	76,000,000
Radial	33,500	20	11,900,000
Way type	8,800	100	8,800,000
Gear Hobbing	15,100	75	12,900,000
Gear Shapers	8,800	60	6,600,000
Grinding			
External cylindrical	40,500	60	30,500,000
Internal cylindrical	16,600	20	5,600,000
Surface	50,100	60	37,800,000
Tool and cutter	63,500	25	25,400,000
Bench, floorstand, snag	103,100	20	34,600,000
Honing	7,500	250	10,700,000
Lathes			
Bench and floor, light duty	67,800	25	27,200,000
Engine and toolroom, heavy duty	124,800	50	83,200,000
Turret lathes, ram type	60,700	35	31,600,000
saddle type	23,400	100	23,400,000
Automatic	21,300	500	3,600,000
Automatic screw machines	63,300	30	29,200,000
Milling Machines	173,500	75	149,100,000
Planers	15,800	150	18,900,000
Shapers	40,000	5	3,800,000
Other Machine Tools	417,000	40	238,200,000
TOTAL	1,673,300	40	$968,800,000

Higher 1950 Speeds And Feeds Double Output On the Same

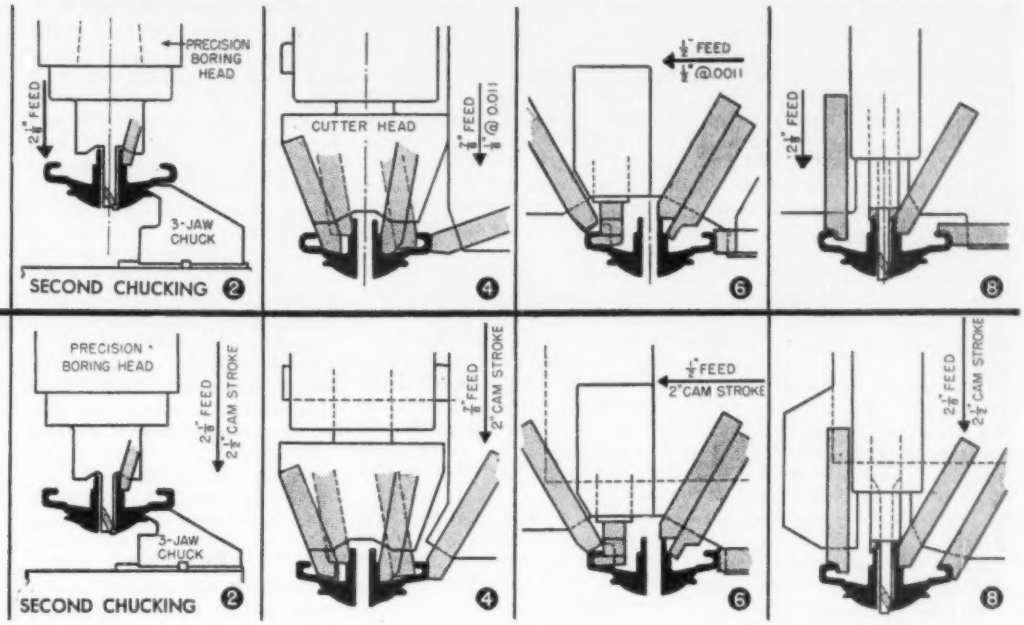


317% GAIN Here the 1940 method of making an aluminum balance wheel is compared directly with two 1950 methods. Speeds and times are in an accompanying table. 1940 and 1950 "single" units are 8-spindle vertical chucking machines. Gains are principally a result of higher spindle speeds.

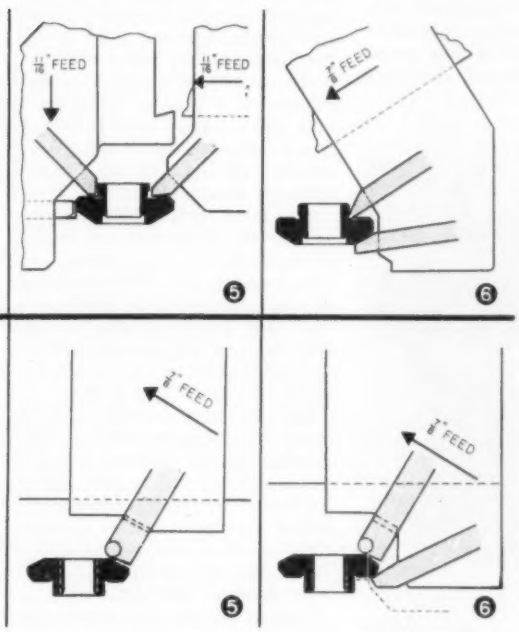


440% GAIN Production of an automotive-differential side-pinion blank was stepped up from 76 to 410 pieces per hour (at 80% efficiency) by this shift from a 6-spindle 1940 model to a "twin 6-station" unit. Again, only one of each pair of tool setups is shown for the "twin." Part is finished in one

1940 Setup; A Changed Setup Doubles It Again In These Examples



The same job may be done as shown on a "twin 8-station" unit, which provides 16 spindles and again doubles production. On sketches of the "twin," only one of each pair of tool setups is shown. Odd-numbered stations are machined on first chucking, even-numbered on the second in this case. Original outlines of casting shaded on first position sketch



chucking in each case. Comparative figures are tabulated. Original casting shape is shown by shading on first-position sketch; part is chucked on splines

Here are the comparative speeds and times on both jobs ...

BALANCE WHEEL (Aluminum Casting)

Sta.		1940 MODEL Sfpm	Rpm	Feed, ipr	Time, sec	1950 MODEL Sfpm	Rpm	Feed, ipr	Time, sec	TWIN 1950 UUNIT Sfpm	Rpm	Feed, ipr	Time, sec
1		Loading				Loading				Loading			
2		370	1800	0.0048	15	620	3000	0.0053	7	620	3000	0.0053	7
		240				465	3000	0.0053		465			
3	Tools	350	300	0.0146	31	1060	1200	0.0136	14	1060	1200	0.134	14
		240	300	0.0083		710	903	0.0134		710	903	0.010	
	Drill	81	621	0.0083	31	186	1200	0.010	14			0.0136	
4		350	300	0.0082	31	1060	903	0.0042	14	1060	903	0.0042	14
				0.002		830				830			
5		222	280	0.0139	32	710	903	0.0063	14	710	903	0.0063	14
				0.0035									
6		290	247	0.0096	32	1060	903	0.0027	13	1060	903	0.0027	13
				0.0024		1000				1000			
						295				295			
7		220	280	0.0068	31	710	903	0.0051	14	710	903	0.0051	14
8		350	300	0.0139	31	1060	903	0.0106	14	1060	903	0.0106	14
						140				140			
Output, pc/hr @ 85%		65				135				271			

DIFFERENTIAL SIDE GEAR

(Forging with splined hole)

Station	1940 MODEL Sfpm	Rpm	Feed, ipr	Time sec	1950 MODEL (TWIN) Sfpm	Rpm	Feed, ipr	Time sec
1	Loading				Loading			
2	98	110	0.0163	25	278	368	0.026	6
3	90	110	0.0163	26	350	368	0.0276	6
4	108	122	0.0163	26	338	368	0.0136	6
5	96	110	0.0148	26	338	368	0.026	6
6	108	122	0.0163	26	338	368	0.026	6
Production, pc/hr @ 80%	76							410

duces three units of 1940 vintage.

In die work, high-speed spindles running up to 40,000 rpm make it possible to use carbide burs on materials once considered unmachinable except by grinding.

Drilling and Boring

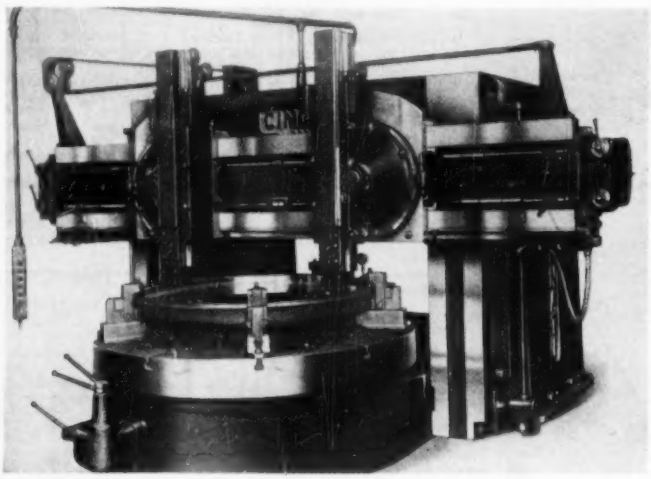
Apparently there has been little increase in speed or feed of standard sensitive and upright drills, although one maker of light types shows an increase of 40%—higher if air operating valves and other attachments are provided. Carbide-tipped drills are not yet to "the point where they are acceptable for the big percentage of drilling operations," so the 25% gains made are the result of application of super-high-speed steels on specific jobs, in fixturing, in feeding and ejecting devices, in coolants, and in heavier, higher-powered machines.

Radial drills are heavier, more rugged, and as a result, more rigid than 1940 models, cutting chatter and vibration. This lengthens tool life between grinds and insures greater accuracy. In most cases as well, controls have been simplified and made more convenient so cycle time is reduced. One maker of a sensitive radial indicates increases to 10 to 20% through reduction of operator fatigue alone, largely because of an adjustable-height table.

On way and production drills, higher productivity has been attained both by machine improvements and by better fixturization. Hydraulic feeds for boring and drilling with carbides, greater rigidity and closer machine tolerances that improve hole quality (and thus eliminate some second operations), better lubrication and reduced maintenance (reducing downtime), anti-friction bearings, transfer mechanisms, and similar developments have combined to increase productivity 25 to 500%, with the average around 100%. Better understanding of the problem of machine warm-up has made it possible to set feeds and speeds in the morning and leave them throughout the day, thus cutting scrap.

One maker says that his 1940 machine would drill 20 to 25 cylinder blocks per hour, as compared with 75 to 80 today—an increase of over 200%.

A jig-borer maker reports his current model 10 to 20% faster than its 1940 predecessor. Rapid traverse and automatic positioning are part of the answer. A new cam-operated precision boring machine is giving 15 to 20% higher output, particularly compound slides and multiple setups.



Time Cut 83%—Locomotive tires formerly required 18 hr to bore. Greater rigidity and higher speeds, with carbide tooling, increase depth of cut and feed and improve finish so much that the job is now done in 3 hr, thus increasing production 500%

Planing and Shaping

Planer speeds and feed ranges have approximately doubled in the last ten years. Horsepower available for metal removal on smaller machines is up about 50%, on larger machines as much as 100%. Simpler, more convenient controls, greater precision and many additional attachments have all helped to reduce operator effort and increase productivity 150% at least. In some typical examples, new machines made these savings: 150%, 350%, 733%, 204%.

On frog and switch planers, increases were 600% and 240%. Another maker reports that a 1940 job that required 18 men is now done by three. A good average would be 80% increase.

Shaper productivity with carbides is up about 20%, but carbides are economical on only 20% of jobs.

Grinding

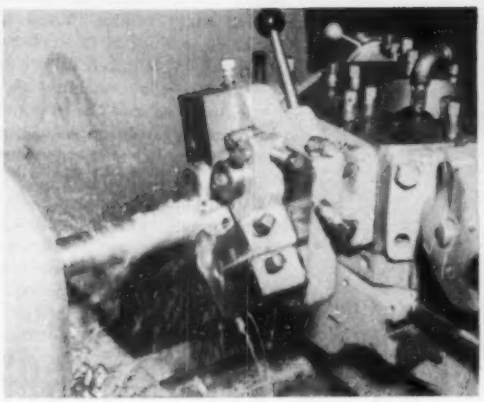
Anything approaching a statistical analysis of productivity increases in grinding is difficult because optimum speed—a mile a minute—has been standard for fifty years or more, and because many grinding jobs are on a tool-room basis. However, present-day machines produce pieces with far higher quality of finish and closer tolerances, with less maintenance.

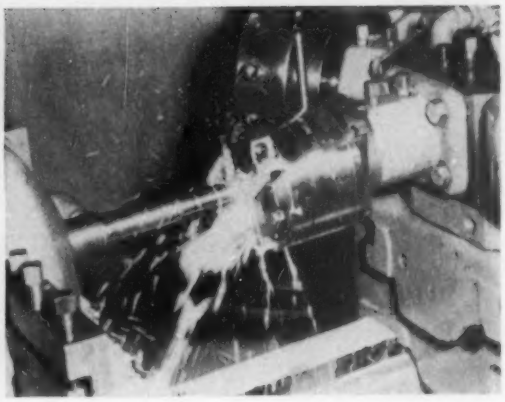
In many cases, too, shift from a general-purpose grinder to a production type has made a major increase in output.

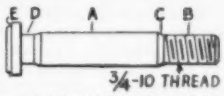
One large maker gives these increases in productivity as recent production-grinding examples: 30% increase, plus $2000 reduction in maintenance cost; production increased 200%; production up 80%, tolerance cut in half; production multiplied by four, tolerance cut to ¼; production fivefold.

Another maker quotes a 60% production increase on a way grinder, another 38% on a cylindrical grinder, plus higher quality of finish, closer tolerances, and reduced maintenance. If the added time required ten years ago to reach these better finishes is considered, improvement is 60%.

Special grinders, of course, show the most spectacular results. A plunge-cut grinder for circular wood saws steps up output from







Turret Hex	Cross Slide	Operation	Spindle R P M	Surface Speed	Feed
1		Stock stop			
2		Point	2000	714	HAND
3		Turn A	2000	714	.015"
4		Turn B	2000	422	.015"
5		Thread B	2000	390	.100"
	Rear	Form C, D & E	2000	714	HAND
	Front	Cut off	2000	714	.0035"

2000-rpm Threading . . This body-bound bolt, of 1¾-in.-dia SAE 1040, is machined complete, including threading and cutoff, at 2000 rpm in a ram-type turret lathe. Body is reduced to 0.813 in. dia in one 9/32-in. cut at 714 sfpm with 0.015-in. feed (left photo). Diameter tolerance is held to 0.001 in., finish within 15 micro-in. Carbide-tipped chasers in the die head produce a thread better than Class III, at about 690 fpm (right photo)

6¾ to 42 saws per hr—*or more than six times.* Another maker says that with multiple wheels, special fixtures and the like, he has attained increases of 200 to 400%. In another case, knife grinders for paper mills and steel mills now produce 300 to 400% faster, because table speeds have been increased to as much as 175 fpm. A surface grinder with a wheel 16 in. wide, used to grind hand-saw blades, has increased output 60%.

Standard surface grinders are reported as 25 to 35% more productive than prewar models by one maker. Another reports table feed stepped up from 30 to 100 fpm by change to hydraulic feed. Because of lowered heating of the piece at the higher speed, plus improvements in weight distribution, in bearings and in design generally, the 3 to 1 ratio of feed increase has been reflected in productivity. Another maker gives no percentages but lists redesign of the saddle for greater rigidity, a shift to higher table feeds and ten new accessories to achieve closer tolerances and greater versatility.

Cutter and tool grinders have been improved in design, rigidity, controls and speed ranges, giving increases in productivity estimated at 25%. Drill grinders, with similar improvements, are now 20% faster.

Floorstand grinders are reported 50% more productive by one maker, 25 to 40% by another.

Broaching

Modern broaching machines are more than twice as fast as their prewar predecessors. 1940 speeds of 20 fpm have now reached 45 fpm, broaching tools have been improved in design so they give more parts per grind, fixtures are faster and frequently include automatic loading and clamping, maintenance downtime has been cut by use of lower hydraulic pressures and better systems, and increases in weight of as much as 25% have increased rigidity, thus lengthened tool life. Tools are being designed to remove more stock per tooth, in some cases by application of replaceable inserted carbide-tipped teeth and carbide blades. Loading time has been eliminated as a cause of machine idle time by using double or triple slides or fixtures so one part or group of parts can be loaded while another is being broached. In one case, addition of a gravity chute feed, hydraulic transfer slide and automatic continuous broaching cycle increased production 64%, in other cases as much as 125%.

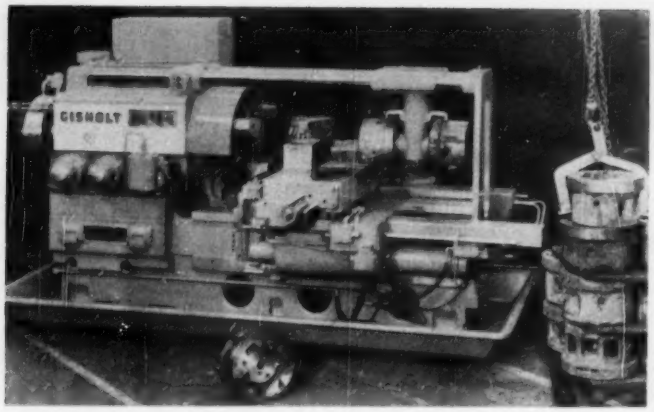
Boring

Horizontal boring, milling and drilling machines average over 100% more prdouctive than their 1940 counterparts, four specific cases running 100%, 120%, 500%, and 938%. Vertical boring mills have done even better, averaging over 250%, three specific cases being 300%, 500%, and 1300%. Special attachments and tooling many push individual cases higher.

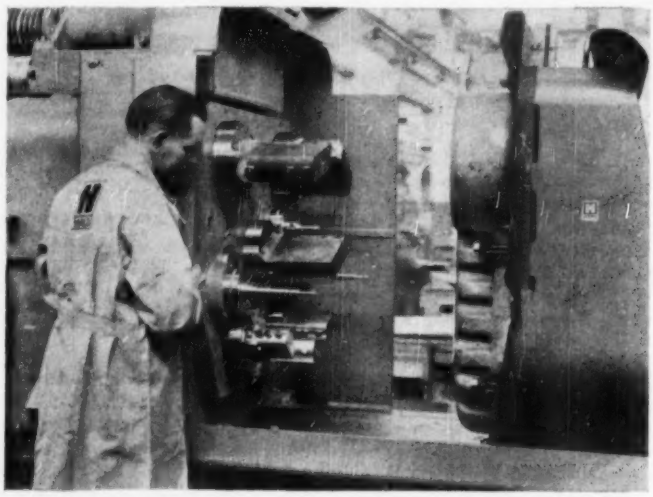
Gear Cutting

Gear shapers of 1950 produce about 25% more than 1940 models, although multi-spindling has in some cases increased production per operator as much as 900%. One maker reports his gear hobbers are working 10% faster on difficult jobs, 75% on typical ones. Bevel-gear generators with automatic loading show gains of 400 to 900% over 1940 units and give better finish. Hypoid finishers are 500 to 700% better; a "rotary-broach" type increases output 75%, needs attendance only every 30 to 45 min, gives better finish.

On chamfering machines, increases are 5 to 10%; from better balance, greater rigidity, improved spindle-bearing design and general refinement. Burring machines,



Power Loader—Large CI cylinder heads for diesels are machined in this lathe with power-operated loader. The operator merely loads one side of the loader, which at the end of the machining cycle removes the finished piece and indexes to chuck the next one. Productivity was thus increased in three ways, faster cycling, higher speeds with carbides, and more parts per grind because machine rigidity lengthens tool life despite intermittent cuts



Replaces Three—Multiple tooling and combined operations enable this large boring machine to bore, chamfer, face and groove diesel-loco drive housings in the same setup. Thus a new method replaces an older one—and three separate machines

on the other hand, are as much as four times as fast as 1940 models.

Better design and better tooling, plus automatic loading, have made gear shavers as much as two to three times faster than their prototypes of ten years ago.

Honing

Productivity of honing machines is better than double that of ten years ago. One company reports stock-removal capacity 2½ to 3 times that of 1940, resulting primarily from research on honing stones and development of new types capable of withstanding much higher unit pressures, permitting higher pressures and higher reciprocating speeds. This, of course, results in higher rates of metal removal. For example, in 1940 a 4-ft hydraulic cylinder was made of steel tubing, bored to allow 0.008 to 0.010 in. of stock for honing, which required 18 to 20 min. With the 1950 machine, boring is eliminated and the cylinder honed directly from mill tubing. From 0.050 to 0.070 in. is honed out in 15 to 18 min. per cylinder.

Another company has doubled machine capacity and productivity, but multiple spindling, addition of automatic size control, indexing, and in some cases, automatic loading and ejecting, have pushed this figure up to four or five times, while holding closer tolerances, reducing scrap, and cutting work of operator and inspector.

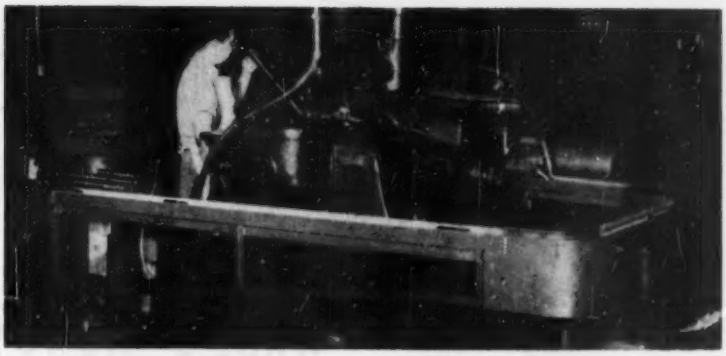
Other Processes

While tube mills operated on ordinary mechanical steel tubing at 40 to 50 fpm in 1940, they now operate at twice that, or 80 to 125 fpm. Cold roll-forming machines have not changed speed (100 to 150 fpm), but automatic cutoff machines have been added to increase productivity 15 to 20%.

Automatic dieing machines have been stepped up an average of 50% in speed, although larger machines which in 1940 operated at 125 strokes per min, now operate as fast as 225. A new line of small, high-speed machines has increased the 1940 maximum of 300 strokes per min to 700, with a broadened speed range to handle a wider variety of work.

Press speeds have been increased by "rapid-traverse" approach and return, even though actual drawing speeds have in most cases been held at the apparent optimum of about 30 fpm. Postwar development of coatings for stock has, however, permitted some speed increases here. Also, application of variable-speed drives, addition of feeds and ejectors, deeper draws (to cut number of draws), and like factors have resulted in productivity increases. On press brakes, multiple operations have increased productivity where applicable; and on shears, use of magnetic gages and similar attachments has speeded the job 50 to 100%.

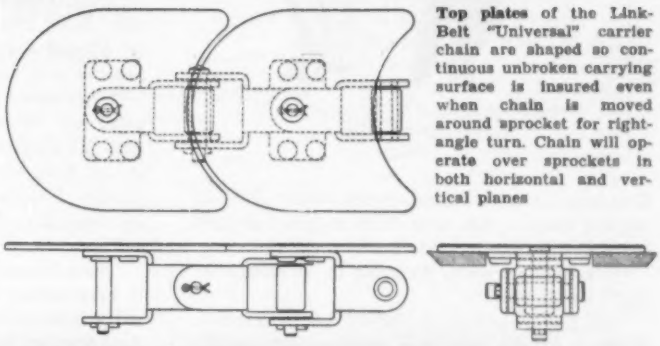
One resistance-welder maker estimates an average increase of 10% during the period.



Continuous carrier-chain conveyor at centerless grinder returns ground parts to front of machine automatically for stacking in tote pans by operator, or for second grind. Conveyor slats and guard rails are faced with Transite to prevent scratching finished surfaces of work

Chain Conveyor Handles Ground Parts

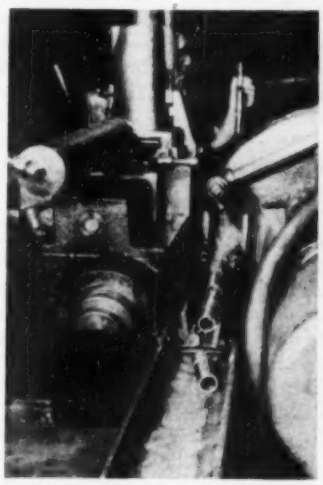
BY JOSEPH KOSINSKI
Works Manager
SCULLY-JONES AND COMPANY



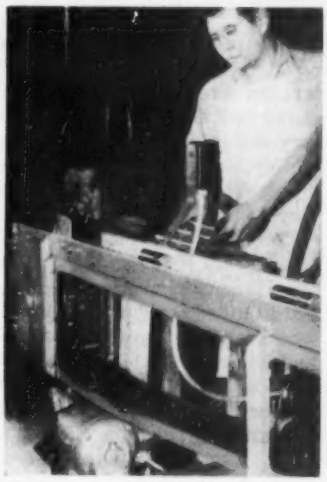
Top plates of the Link-Belt "Universal" carrier chain are shaped so continuous unbroken carrying surface is insured even when chain is moved around sprocket for right-angle turn. Chain will operate over sprockets in both horizontal and vertical planes

NOVEL slat-type conveyor recently installed at the Chicago plant of Scully-Jones and Company returns parts to the loading side of a No. 3 Cincinnati centerless grinder without attention from the operator. Originally developed for handling bottles, cans, jars and other containers in food and beverage processing plants, the carrier chain conveyor employed in this unit is especially suited for handling finely ground parts. Construction permits a continuous unbroken carrying surface of equal width whether the chain is moving in a straight line or turning around a sprocket. Chain is so designed that it permits sprocket engagement in two planes as the conveyor makes right-angle turns without changing the level of the work-supporting surfaces.

Built to Scully-Jones specifications by J. R. Hooper Company, the conveyor has 33 ft of 4 1/2-in. wide, 3-in. pitch Link-Belt "Universal" carrier chain and is driven by a 1/3-hp constant-speed gearmotor. Steel top plates of the carrier chain are faced with 1/4-in. thick Transite cut to the shape of the plates and riveted in place.



Guide bars deliver ground parts from centerless grinder to slats of continuously moving conveyor. Conveyor makes two right-angle turns. Coolant is drained from parts before they reach conveyor



Drive gearmotor mounted under discharge end of conveyor moves chain continuously at 44 fpm. Before chain passes over drive sprocket, curved plate rolls workpieces off conveyor onto tray convenient to operator

ROUND TABLE

What's News?

It was just after the four o'clock buzzer. Ed had walked over to Al's tiny office and had draped his lanky frame over the beat-up desk.

"Hear as how we're all going to become writers?" he queried.

"No, Ed, what's it all about?" Al continued, stuffing papers into the overflowing middle drawer.

"The new plant magazine is coming out in about a week, and the Big Boss sent out word that the foremen are expected to send in interesting stuff about the different departments that they can print."

"Boy," laughed Al as he slammed the drawer, "I've got a couple of interesting ideas that I'll bet they'd be afraid to print!"

"Yeah, I'll bet you have! But I take it that rough jokes isn't exactly what they're looking for. Harris told me that the boss is really interested in the magazine, and he wants some good, soothing plugs for the company. He must figure that he can keep the labor situation under control a little better if he has the foremen exclaiming about how nice it is to work in their departments."

"Well, it might be a good idea," mused Al. "We don't have any trouble right now, but it could be a good way to keep people thinking in a healthy way about the company."

"I wondered how you'd react to the idea," replied Ed. "Personally, I think it stinks. I suppose the magazine's a good idea, but I think they should keep big ideas out of it. Besides, I have plenty of work to do without having to write up some darn-fool hokum every other week or so."

"Now, Ed, you know you wouldn't have to do it very often. I know they wouldn't put in a story from more than one foreman each week. And another thing," Al was getting warmed up to the idea, "And not hokum. Some good stuff —if they put it the right way—would do a lot toward improving general interest and morale. That's the important thing, anyhow."

"Sure it's important, but I do enough just keeping my boys happy."

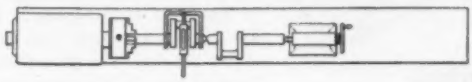
"Yeah, I noticed Cummings teeing off at you the other day. He looked real happy!"

"Well, that's just one case. He was all hopped up about overtime, but we got it straightened out OK. The thing I'm driving at is that a plant magazine is supposed to stick to news and gossip and harmless junk like that. When they start poking their editorial nose into how the plant is run—that's not news; it's propaganda!"

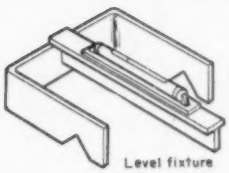
"Maybe so, Ed, but a magazine is sure an easy way to spread around a little propaganda—and actually it doesn't hurt anyone."

SHOULD COMPANY PUBLICATIONS *stick to the lighter things; or, as Al suggests, can they be used to promote the company? If it is done well is it really to everyone's advantage; or is it actually clouding the facts? Discussions of earlier topics appear on later pages.*

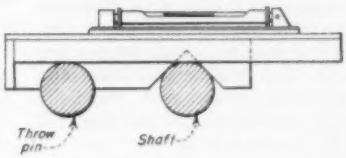
Practical Ideas



Lathe Setup



Level fixture



Spiral Welding and Fixture Repair Broken Crankshaft

CRUDE CRANKSHAFTS, like those on some farm machinery, can be easily welded by eye, but for accurate work on pumps or engines, more careful work is required. To alter the web lengths of several loom crankshafts, we devised this method that involves a level.

The welding jig is made of a U-shaped member to which is welded a vertical piece that bisects the U, and a horizontal piece that rests on top of the other. Both the top face of the upper central piece and the lower edge of the lower central piece are ground flat. Two 90° notches are cut in the edges of the U.

First the fixture is laid on top of the section of the crankshaft that is chucked, and the web is made level by turning the chuck. Then the chuck is locked in position. Next, the web closer to the tailstock of the lathe, which is held to the rest of the crankshaft by a drive-fitted pin, is leveled, too.

Welding is started with the work in place on the lathe. After some bead has been laid, the chuck can be unlocked and rotated so welding is always downhand. When the bead is about ¾ finished, the work is rotated back to the starting position and the webs are checked with the level. Corrections are made by the welder, who can spiral weld to correct errors that total not over 1° in angular position.

We have found that spiral welding with this kind of setup produces good accuracy. The technique consists of laying short beads in a helical direction; if the right-hand section is slightly back of the left, the welder lays short beads from upper right to lower left to rotate the sections slightly in relation to each other. *Michael P. Blake, Charleston, W. Va.*

Bearing Balls Make Radius Toolbits

FOR SOME SIZES, accurate and handy radius toolbits can be made by taking bearing balls, cutting or grinding off about half the sphere, then brazing the remainder to a steel shank.

The balls are precision ground, so the radii are perfect. Although balls of all sizes cannot be found, the ones that can will be worth the effort because of their excellent condition and surface.

If more convenient, the balls can be brazed first, then ground off flat on top for rake. *Carl Schickler, Rochester, N. Y.*

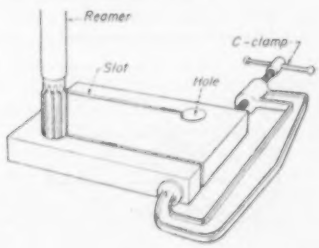
Lapped Reamers Cut to Press-Fit Size

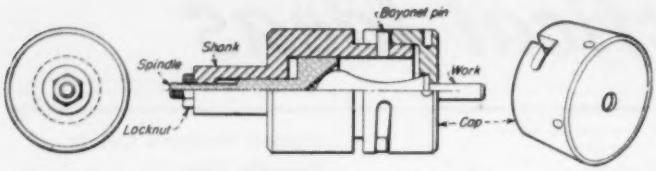
DOWEL HOLES that will grip pins in a press fit are often called for when the dowels are to be used as they are and not ground down. Reamers are usually sold on size, or slightly oversize, and normally they will not work on this job. Grinding standard reamers down to a slightly smaller size is difficult and expensive. However, they can be lapped down with a minimum of time and trouble.

The lap can be made by drilling and reaming a hole of the required size in a piece of cast iron or soft steel. The regular reamer size is used on this hole. Next a slot is sawed into the hole from one edge of the piece. When the plate is gripped tightly by a C-clamp, the size of the hole is reduced slightly.

To do the lapping job, the reamer is chucked in a vertical mill, lathe, or drillpress as long as the machine will run in reverse. The machine spindle should be operated slowly while the plate is moved up over the reamer. As the reamer continues rotation, the C-clamp is tightened slowly and the plate is moved up and down to provide an even job on all the flutes. The reamer can be checked occasionally to make sure the lapping job did not go too far.

Running the reamer backward while lapping has a tendency to cut a slight clearance on the heel of the flute, and to leave the cutting edges sharp so they will cut freely and hold up well. *Basil Clark, Evansville, Ind.*





Wedging Chuck Grips Handles

METAL TOOL SHANKS formed into round handles had to be remachined because they were oversize. Ordinary chucking would have been impossible on account of the odd shape of the handles, so a special bayonet chuck was made.

Spindle action of the chuck, which can be gripped in a three-jaw conventional chuck or a collet, is like a lathe spindle with a drawbar. An internal shank is formed at the end to a cone that will exert end pressure against the part, and this is controlled and set by a hex nut working at the left end of the chuck. The internal shank fits closely inside the machined body of the chuck.

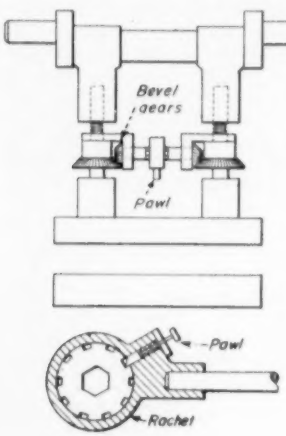
The right end of the part is held by a drilled cap that fits around the shank of the tool handle. This is held to the body by two bayonets fitted to the chuck body which engage a pair of slots in the cap. These slots go straight in, then turn to angle slightly forward; so the cap is mounted simply by pushing it in, then turning it until the bayonets jam in the slots. Pin holes are provided around the cap so it can be loosened easily.

Although this chuck is for a special purpose, other work can be mounted by readjusting the position of the internal shank and fitting a new cap to the body. If desirable, the cap can be drilled out and a number of adapters can be made to provide end holes of the right size for other workpieces with different diameters.

An important feature of the chuck is that it mounts work quickly. One way to use it is to insert the tool handle in the hole in the cap, grip the two parts in the right hand, then mount the cap and jam it tight. *W. M. Halliday, Southport, England.*

Press Ratchet Replaces Wrench

ADJUSTING RAM SCREWS on a number of presses in our shop was a tough job until we rigged permanent ratchets to take the place of the heavy, open-end wrenches we normally had to use. The replacement also saved a lot of hard work.

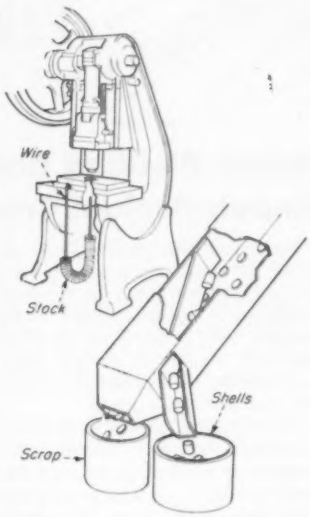


The press ram illustrated had two parallel adjusting screws. By mounting a pawl that was adjustable for up or down motion on the hex section of the drive rod between the two sets of bevel gears, we made it possible to insert a bar in the pawl and move the ram up and down quickly, thus turning the screws. The setup man only has to insert the bar and adjust the pawl; then hang on lightly until the screws move the ram the required amount.

Minor adjustments are just as simple as large ones, and large wrenches do not have to be carried around and stored. *Kenneth L. Stoltenberg, Milford, Mich.*

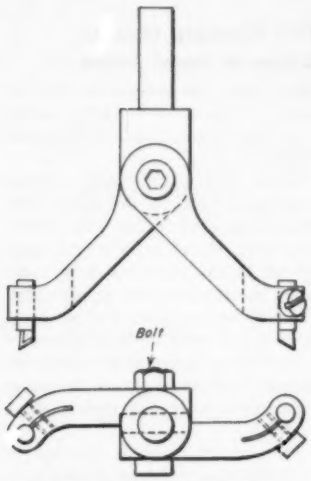
Separating Punched Parts From Scrap

PUNCHED PARTS with holes through them can be separated from the scrap by attaching a heavy wire to the press and looping it under the die cavity so its end is close under the die. The good parts fall through the die and onto the wire, while the scrap falls right by into a chute.



On another job, small drawn shells had to be separated from trimmed scrap. This was done after the material was air-ejected from the die onto an inclined chute. A strip of scrap angled across the face of the chute and about ½ in. above the surface of the chute stopped the shells and channeled them into a container. The scrap, being flat, passed underneath the strip and fell into a bucket. *Bernard Levowich, Brookline, Mass.*

COPPER ROLLERS on seam welders will open slip when tanks are being joined because the rolls become smooth with wear. This makes production difficult and often causes faulty welding. By setting the spacing just under the width of a coarse file and running the file through the rolls, a knurl will be produced. *Roger Isetts, Kenosha, Wis.*



Adjustable Flycutter Mills Smooth Channels

TO MILL a number of channels of different widths on a small number of parts and to produce a good finish, we developed a sort of adjustable flycutter that carries two toolbits.

A shank fitted the spindle nose of the vertical milling machine, although similar tools could be utilized on boring mills, lathes, and drills. Two bent arms that actually carry the toolbits are fastened to the shank by a heavy bolt. Both arms are drilled through and slotted for round carbide toolbits, and are provided with small capscrews that clamp the bits.

All the parts were finished with one sweep, and the finish was good. Width of the slot was determined by fitting the toolbit to a vernier gage, then locking the large bolt securely to prevent spreading of the two arms.—*N. Bonamini, Glasgow, Scotland.*

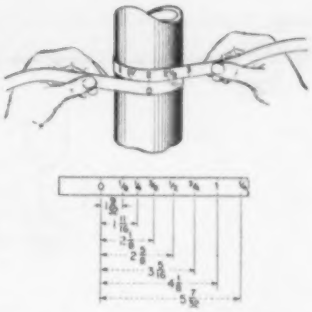
DELICATE INSTRUMENTS with supposedly dustproof cases are sometimes put out of commission by small particles that seep in. Here's a way to seal them: I apply common, clear fingernail polish around all broken edges, matching edges, and around the viewing glass. *Charles W. Shutt, Alma, Mich.*

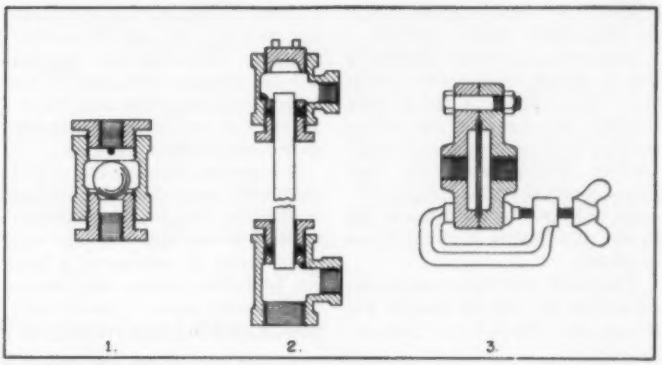
Pipe Tape Shows Nominal Sizes

TO PREVENT costly errors when pipe is being ordered or replaced, this measuring scale on flexible tape is handy. The markings are in nominal pipe-diameter sizes but the measuring is actually done around the circumference of the pipe.

First the nominal pipe sizes are converted to the actual pipe diameters they represent. Then the diameters are converted into circumferences, and these spacings are laid out on the tape. Some space to the left of the zero mark is left to allow for holding the tape.

After the actual pipe-circumference marks have been placed on the edge of the tape opposite the zero mark, the nominal pipe sizes they represent are marked opposite the lines. Thus, a direct measurement around a pipe will show the nominal pipe size immediately. *H. G. Frommer, Milwaukee, Wis.*





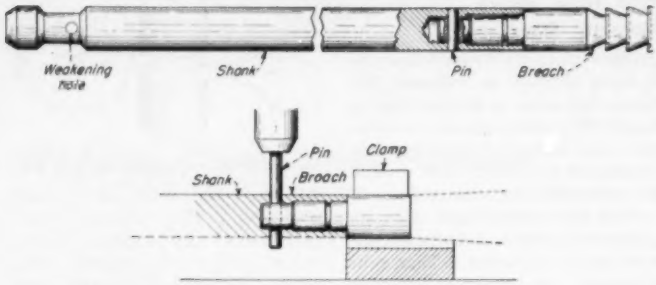
Three Shop-Made Fittings Control Liquids in Emergency

BECAUSE we often do not have special fittings made of stainless steel, we had to make up the three illustrated ones for emergency use.

The first is a simple check valve with two seats that are threaded into the body. The ball can be either a stainless-steel ball, or can be a glass marble. A spot of stainless weld is located near the top seat to prevent the ball from seating as it is forced up—thus allowing fluid to flow past.

The second fitting is a level indicator. Made with two end fittings that were machined from stainless, it consists of rubber rings or packings, a glass tube, and two pressure rings. Both rings are held into the end fittings by tack-welded spots on the pressure rings. The flanged bushings are tightened to force the rubber rings against the glass, which seals the tube at both ends.

The third fitting is an improvised filter made from two simple flanged parts. The filter disk is clamped between the relieved surfaces of the flanges by C-clamps. Three or more clamps are necessary. *Pablo Redl, Buenos Aires, Argentina.*



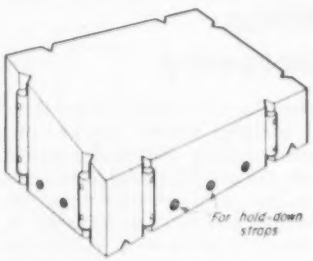
Pin-Aligning Method Connects Broach and Shank

LONG SHANKS on broaches are useful, but short broaches are much easier to turn, harden and grind. Broaches and shanks can be made separate and fitted together, but the connections must be precise.

Two precision-ground diameters and a thread connect the broach and shank. Force is transmitted through the threads, and a pin through both components prevents turning. The problem was how to get a proper fit for the pin, because the hole in the broach had to be drilled before the broach was hardened.

After both parts were completed except for the hole for the pin, the broach was clamped in a good V-block, the pin was chucked in a drillpress, and the V-block was clamped to the table. The broach was aligned so the pin could be dropped through it, then the shank was threaded onto the broach and clamped. The drill was chucked and run through two sides of the broach to finish off the hole. Finally, the pin was inserted and the broach was ready to be used.

The section through the end of the broach shank should be smaller in diameter than the threaded connection, so that any breakage will occur there. If necessary, a hole can be drilled through this section to reduce the area. *A Vetsch, Steffisburg Station, Switzerland.*



Sine Block Locates Large Part for Milling

ANGULAR SURFACES on 15 aircraft parts were at all angles and in different planes. To machine all surfaces except the bottom, which was the locating surface, a setup was made with the illustrated sine block. The block was planed off at a slight angle on top to set up the workpieces so their tops could be easily machined at this odd angle.

V-notches cut in the sides of the large block were fitted with small precision rollers, bolted in place. These were accurately located to provide perfect alignment on top, bottom, and all sides. Holes into the block permitted holding the block down to the machine table with strap clamps.

By keeping a parallel strapped to the milling table or jig borer, it was easy to turn the sine block, to which the work was clamped, to any desired angle in relation to the strap. *S. Grant Bloomer, Syracuse, N. Y.*

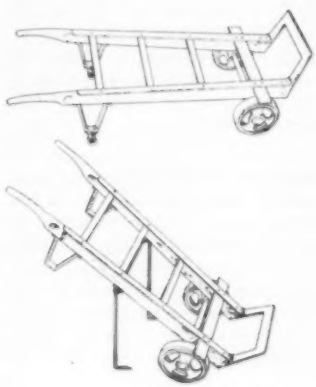
Two Changes Increase Value of Hand Trucks

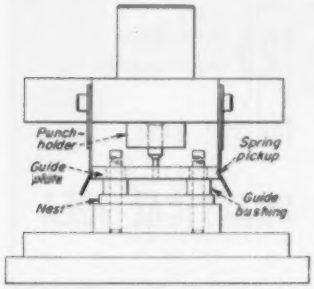
HERE ARE two things we did to some of our hand trucks to make them more easily handled and more useful.

First, we added small swivel castors to both of the fixed legs. This permitted using the trucks like four-wheel carts when loads of 150 to 200 lbs were to be handled in our shipping department. Because we scrapped our old hand trucks and wanted to standardize handling equipment, we could now handle loads two ways on the same equipment after the casters were added.

Second, to make it possible to stop the load and hold it steady at any point, we added a set of convertible legs. These were made of one length of heavy rod, hinged on the truck frame, and fitted with one spring clamp to hold them up out of the way when desired. If a trucker wants to stop to rest the load, he can kick the legs down easily to balance the load only slightly behind the point where it would topple over the front—thus requiring little effort to lift it to get going again. The two alterations can be made to a lot of trucks at one time, so the changeover is economical.

Both changes had wide acceptance in the plant, and probably can be done to many similar trucks in other plants. *Frank M. Butrick, Jr., Alma, Mich.*





Press Pick-Up Lifts Finished Parts

ASSEMBLING small pins into parts or plates can be made easier if a pick-up plate is added to the press tooling. In the illustrated press arrangement, the part is located in a nest, the pin is placed in a guide plate, and the punch forces the pin into the part. After this, the guide or pick-up plate is stripped with the punch, so the assembly can be easily removed.

Two bent springs on the top die come down with the punch to catch in notches in the pick-up plate and lift it when the ram raises again. The die set is fitted with suitable guide bushings so alignment will be accurate. With this method the operator's hands are in less danger, and the pin is constantly guided under pressure.

The assembly lifts completely out of the nest with the guide plate and therefore can be picked out of the press easily by the operator. *Anthony Gabriele, Brooklyn, N. Y.*

Slow Feed Drills Long, Small Holes

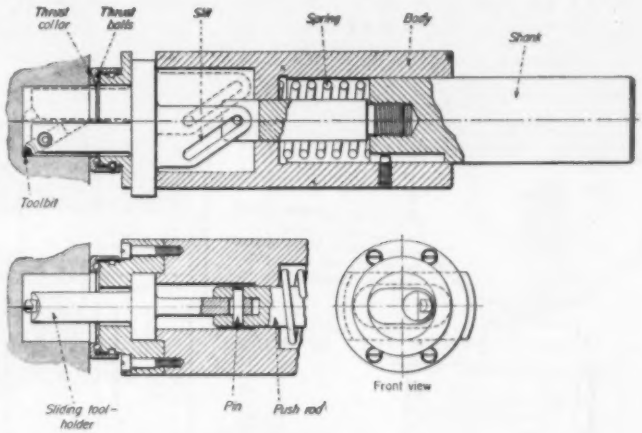
WE HAVE a repeated problem on drilling long (3 to 4 ft long), small (1/16 to 3/32 in.) holes in copper stock. These are for special ferrules in automatic welding machines. Our technique, as finally worked out, was to drill as slowly as possible.

Our first difficulty was in not having high-speed equipment, so we had to hand-feed the drills in old lathes. This caused a poor relationship between spindle speed and feed which caused a great amount of drill breakage and produced fine, dust-like chips that showed the cutting was not right.

By slowing down both feed and speed until the operator could maintain feed fairly accurately by hand, we managed to cut drill breakage. We cut so slow, in fact, that everyone predicted sure failure; but it worked.

We still had to back out the drill frequently to clear the chips, but we tried carbon tetrachloride as a lubricant and found that we could eliminate the backing-out process. A few drops of the liquid was placed on the drill before each hole was started.

The final result was no drill breakage, and no backing out to clear chips. Admittedly the method is slow, but we are saving drills by the score, and, as evidence that the cutting is going right, we produce spiral chips up to 8 in. long which are uniformly 7 thousandths thick. *H. G. Frommer, Milwaukee, Wis.*

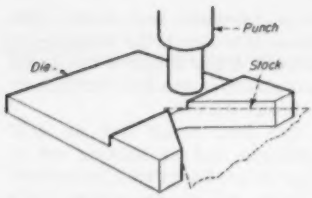


Turret Tool Finishes Hole Bottoms Square

SQUARE BOTTOMS can be produced on bored holes by counterboring tools, or by end mills, but sometimes we have to machine holes to high accuracy and fine finish. To do this I have designed a shifting toolholder which carries a single-point tool.

The shank is mounted in a turret hole on a lathe with some clearance between the turret and the end of the body of the device. As the turret is advanced into the work, a thrust collar and thrust balls take end pressure of the body and stop it. Further motion of the turret works the shank against a coiled spring. The end of the shank is pinned to the toolholder through a slanted slot. As the pin pushes against the slot, the toolholder is shifted from the edge of the hole to the center. Endwise motion of the tool is controlled by the body, so the tool cannot dig deeper than the dimension it is set for by the spacing of the thrust bearing. The location of the slot in the end of the toolholder, and the length of the slot, determine how much shifting the toolholder will do when it is thrust forward.

Adjustments for larger holes or different motion of the toolholder can be made by removing the thrust head and changing the slot on the toolholder. For such cases, it is possible to bolt a new slotted plate to the end of the toolholder. *Nobuo Arakawa, Tokyo, Japan.*

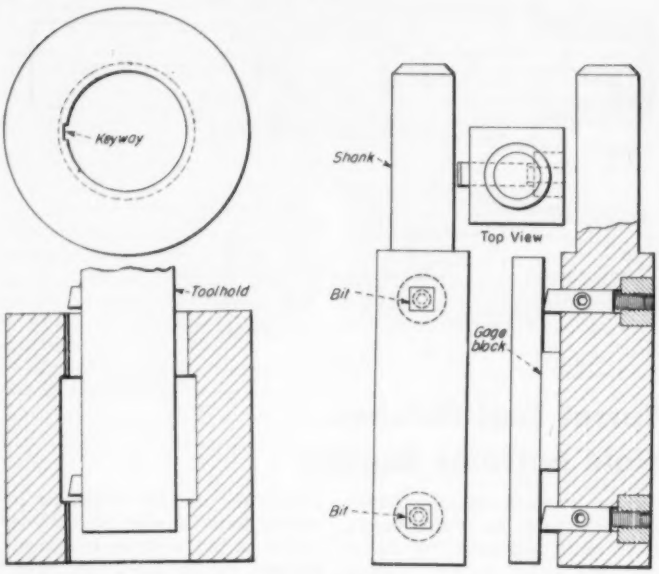


Notched Die and Punch Round Off Plates

A KICK PRESS with punches of standard diameters did a difficult job of rounding off the corners of several hundred thin plates.

Ground flat stock ½ to ⅝ in. thick was drilled and reamed for the required radius. Then a 90° notch was bandsawed into the plate. The back side of the block was shaped down to about half the original thickness to leave two shoulders which would catch the work by two edges. Stock was located so the point would rest back of the notch.

The die was lined up with the round punch, and the work was laid in the die engaged by the high edges. The punch of the same diameter as the hole drilled originally in the plate pushed the stock down and trimmed off the corner. *Bernard Levowich, Brookline, Mass.*



Double Slotting Holder Cuts Separated Keyways

FOR SLIDING KEYWAYS in a long cylinder that was bored and recessed, a special tool had to be made up because the only slotter available had only a 5-inch stroke. As the work was 8 in. long, a single slotting tool would not have done the job. A sturdy toolholder was fitted with two ⅜-in. tool-steel bits located 6 in. apart. These were gaged in position by a parallel strip against a straightedge after the bits had been inserted. Drilled and tapped plugs were set in behind the toolbits to carry setscrews.

After the toolbits were gaged to extend the same amount into the workpiece, slotting was a simple process. Because the toolholder was heavy and rigid, the work was quite accurate. *Ben Goodwin, London, England.*

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420F	Over 0.15 to 0.45	1.00	12.0-14.0	0.18-0.35	
440F	.95-1.20	1.00	16.0-18.0	0.10-0.20	

typical mechanical properties

Type	As Quenched Hardness		Stress Relieving Temp. °F.	Ultimate Tensile Strength, psi	Yield Strength 0.2% Offset psi	Elonga. in 2", %	Hardness	
	Brin.	Rock.					Brin.	Rock.
416	410	C43	600	180,000	140,000	13	375	C39
420F	540	C54	600	230,000	195,000	8	500	C50
440F	610	C60	500	285,000	275,000	2	580	C57

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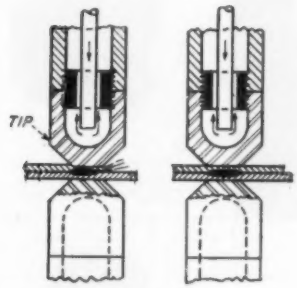
REFERENCE BOOK SHEET

Bad and Good Resistance Welding . . . I

ONLY proper design will permit manufacture of a welded product at reasonable cost, and with few rejects and a minimum of rework. Before design of the product is completed, survey the welding equipment available, because it is a determining factor. And make a hand-made sample fastened with screws or clamps, or a cardboard scale model to develop joint locations. These will show if joints will be readily accessible to the machine and will not require changes in fixture and electrode setups while completing one assembly.

BY R. T. GILLETTE,
Works Laboratory,
GENERAL ELECTRIC CO.

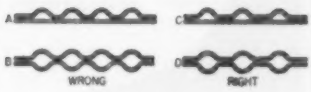


AMOUNT OF OVERLAP

Insufficient overlap of a spotwelded joint results in a weak, porous joint, and perhaps even a void. Not enough cold metal surrounds the spot to confine the molten metal properly, if the correct size of electrode is used. For the proper amount of overlap and electrode size, see reference 1, tables 1.1 to 1.8, and reference 2, p403-418

CURRENT PATH

In a lock seam, current does not pass directly from electrode *A* to electrode *B*, but flows along the path of least resistance *C*. For this reason, a straight lap or flange joint is preferred for spot- or seam-welded products. Besides, the members can be pushed or forged together without excessive pressure



TOO LITTLE CONTACT

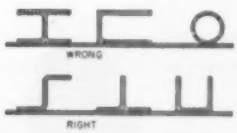
Narrow convolutions like the curved contact surfaces at *A* and *B* will not accommodate seam-welding wheels and spot-welding electrodes. Result: area of contact is so small that excessive distortion and metal expulsion from weld will occur. Flat contacting surfaces *C* and *D* produce satisfactory heat-transfer devices. For rules on wheel widths, electrode sizes and widths of flat, see references 1 and 2

FIT UP

Poor fit up of flanged members cannot be corrected by the welding machine, because copper electrodes lack sufficient hardness. Use of poorly formed components results in a product that is out of square, may be deformed at the welds, or a hole is burned through the parts. Variation from the optimum 90° flange may amount to 3° to 5°, depending on metal gage, stiffness and requirements of the structure

BLIND JOINTS

Reinforcing members with turned-under flanges are difficult to weld. In the first place a copper arbor, which is difficult to remove and replace, is required to prevent crushing the part and to provide an electrical path. And secondly, erratic welding results are produced, because of varying contact resistance along the seam. Preferred method is to keep the reinforcement simple and its flanges accessible to the welder



SECTION SHAPE

Channels, tubes and I-beam sections with wide flanges are difficult to weld to a flat sheet. They require special electrodes and equipment. Welding costs and maintenance are increased, and the results are erratic. Such troubles can be avoided by choosing simple sections that are easily reached with standard electrodes and equipment

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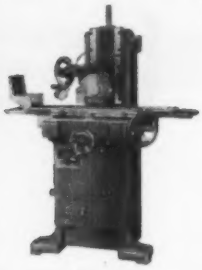

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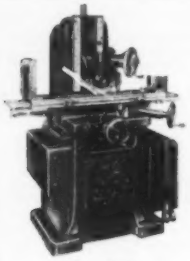

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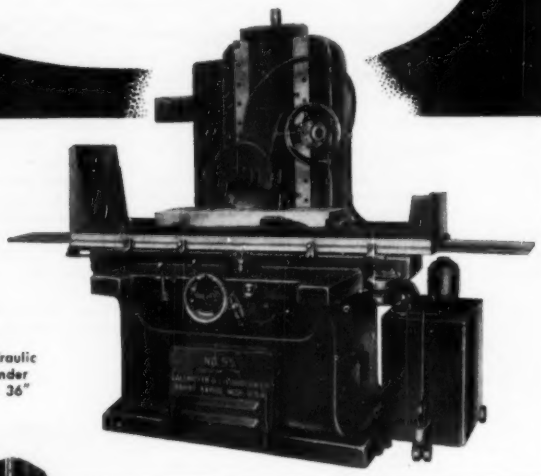
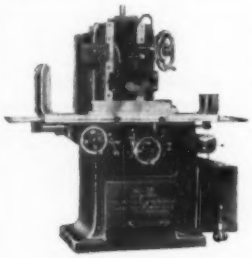
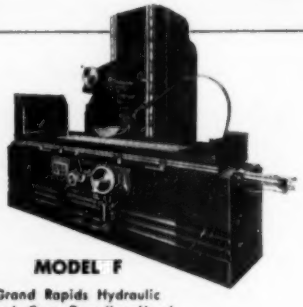
Grand Rapids Hydraulic Feed Surface Grinder
Size 6" x 10" x 18"



No. 55
Grand Rapids Hydraulic Feed Surface Grinder
Size 12" x 17" x 36"

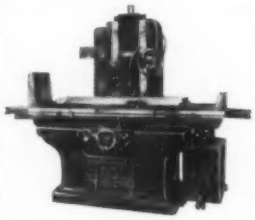


No. 35
Grand Rapids Hydraulic Feed Surface Grinder
Size 8" x 12" x 24"



MODEL F
Grand Rapids Hydraulic Feed, Cross Traveling Head Surface Grinder
Size 16" x 25" x 48" to 24" x 25" x 96"

GRAND RAPIDS GRINDERS



No. 65
Grand Rapids Hydraulic Feed Surface Grinder
Size 12" x 17" x 48"

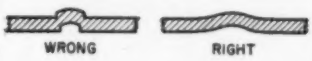
Bad and Good Resistance Welding . . . II

CONTAINER HEADS

Poor forming or incorrect size of container heads and bottoms will result in defective seam welding of tanks. Common faults are: flange toes in, *A*, toes out, *B*, or is skewed, *C*, preventing good metal-to-metal contact. If the head is too small, as at *D*, the surplus metal in the tank wall is gathered into a wrinkle, the joint cannot be pushed together by the machine, and current burns a hole through either or both parts. All container ends should be properly formed and a press fit in the shell

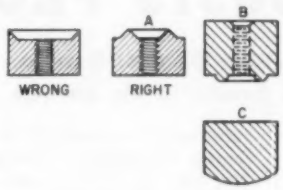
SKID-PROOF PROJECTIONS

Typical round projections on a box cover will very likely skid off the mating edge of the container, when current and welding pressure are applied. Preferred practice in such work is to form elongated projections in the cover and to use an adequate fixture for locating the parts on the welding machine



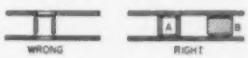
PROJECTION CONTOUR

If a projection is practically punched out of the sheet, it may drop out during welding, or burn off just above the straight section because of local high resistance, or flatten and act to separate the parts. A good projection weld starts with point contact and has a continuously increasing cross-section to the full area of the weld



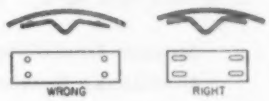
STUDS AND BOSSES

An unsupported edge on a projection-welding stud or boss tends to spread outward under heat and pressure, preventing a good weld. Symmetrical design *A* will produce good welds in sheet up to 0.091 in. thick, but may collapse on thicker material. Design *B* is then preferred, because its larger cross-section permits generation of adequate heat in the sheet or plate. Solid studs *C* are suitable for wide range of stock thicknesses



PROJECTION-WELDED SPACERS

Unsymmetrical projections on spacers cause the same difficulties as with studs. If the spacer is to be a tubular part (to carry a rod or bolt as in conveyor chain), round the ends of the tube, as at *A*. If a solid member is desired, round the ends of the spacer as at *B*



PROJECTIONS FOR CURVED WORK

No weld, or a cold weld, results when the usual round projection is employed for a part that is to be attached to a curved surface. As pressure forces the parts together, hot metal in the bracket contacts cold metal on the curved surface. This change in contact relationship is overcome by using projections elongated in the direction of movement

---

References:
"Recommended Practices for Resistance Welding." American Welding Society.
Welding Handbook, 3rd Ed. American Welding Society.

S.E.C.O. BOOSTS PRODUCTION 22%

Sunoco Emulsifying Cutting Oil Ends Rusting, Decreases Downtime, Results in Big Savings

When an emulsifying cutting oil is unable to prevent excessive rusting on machined surfaces, that's bad. But if, in addition, it has an offensive odor, that's worse . . . especially if you have to change it twice a week and thoroughly clean the machines. Three years ago a large manufacturer of electrical products sought a solution to just such a problem. It occurred in his machining of cast iron end-bearing cages for induction motors.

His search ended when a Sun representative introduced him to Sunoco Emulsifying Cutting Oil. Not only has S.E.C.O. prevented the rusting condition, but also cutting fluid changes are now spaced six weeks apart. Translated into management language, the performance of S.E.C.O. has boosted production, curtailed costs, effected savings. By sharply decreasing downtime, it has increased output 22 percent. Savings on oil and maintenance costs are amounting to almost $5,000 a year. The manufacturer is so well satisfied with Sunoco Emulsifying Cutting Oil that he uses it now in every machine which requires a soluble oil.

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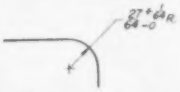
SUNOCO

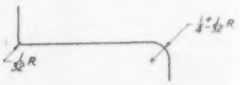
Rules for Dimensioning..III

RADII

In dimensioning radii it is desirable that the leader pass through the center of the radius with the dimension, always followed by "R.", placed between the arrowhead and the center.

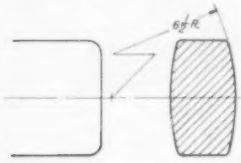


When the recommended practice shown above is impossible due to the size of the radius or the nature of its dimension, it is permissible to extend the leader beyond the arrow and place the dimension on the convex side of the arc.



Where the nature of the part or the size of the radius does not permit the arrowhead to be placed in its proper position between the outline of the part and the radius center, the arrowhead may be placed on the convex side of the arc.

The centers of radii may be indicated by a small cross where this tends to clarify the drawing.

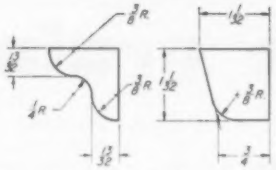


Where the center of the arc of a given radius lies outside the limits of the drawing, or within the boundaries of another view or other data, the leader may be broken. Only one break should be used, and that portion of the leader which ends in the arrowhead should point to the actual center of the radius.

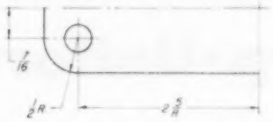
TRUE RADIUS

In dimensionnig a radius in a plane not perpendicular to the plane of projection, such as a radius projected from an inclined surface, the term "TRUE R." may be used as a matter of convenience to avoid showing an auxiliary view.

LOCATING RADII

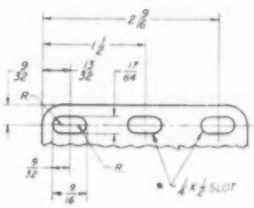


The center of a radius is not located, especially if it falls outside of the outline of the part. It is preferable to locate the intersecting points of its tangents and merely dimension the radius.



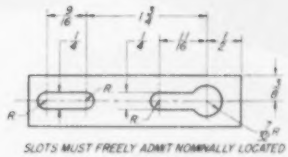
In cases where the center of a radius falls on the center of a hole or on some other centerline which has been dimensioned, no additional location for the radius is needed.

SLOTS



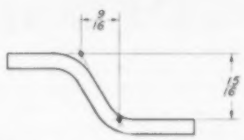
Slots of regular shape for the purpose of compensating for inaccuracies of manufacture or to provide for adjustment are dimensioned for size by overall length and width dimensions, and for location by dimensions to their centerlines.

* Slots in sheet metal made by standard punches are specified as shown.



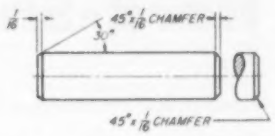
Slots which are intended to perform a mechanical function and whose size and location are subject to gage inspection are treated as two partial holes separated by space and dimensioned as such.

OFFSETS



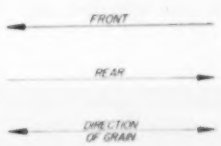
Offsets are preferably dimensioned from the points of intersection of the tangents and to the same side of the material.

CHAMFERS

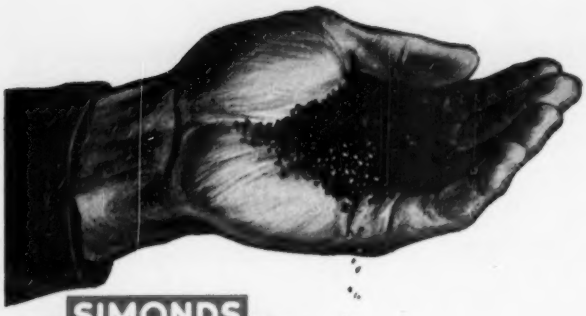


When a chamfer is specified by a note as "45° x 1/16 Chamfer" it is understood that the linear dimension is taken parallel to the axis of the part and not along the angular face of the chamfer. Chamfers other than 45° are specified by dimensions applied to the appropriate view rather than by a note. The purpose of this practice is to avoid misinterpretation.

DIRECTION



To indicate Front, Rear, Direction of Grain or the direction for special views, use a simple heavy arrow.



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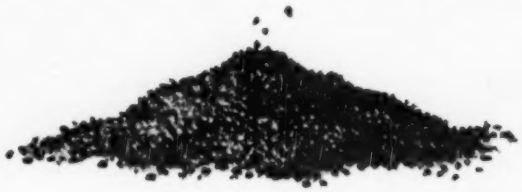

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TALKING SHOP

Cold Extrusion

BOMBRINI PARODI-DELFINO, Italian arms factory destroyed by the retreating Germans, claims to have originated cold extrusion of steel in 1936, making a copper-clad ½-in. dia shell case of H-cross-section from a bimetal disk. Later the company produced 2-cm and 4-cm shells by extruding hot-rolled bars. An executive talked in 1939 to a German friend, so the secret was out. Currently, the same presses, repaired, are making insecticide bombs and sockets for textile spindles—at rates 1/10 of those in 1939. The story seems logical enough, particularly when one remembers that macaroni and spaghetti are both extrusions.

Larger Jaw

To INCREASE throat depth of a bandsaw, a British engineer has developed a 3-wheel (at least) unit. One bandwheel is fixed, two are adjustable in a roughly triangular pattern. The fixed wheel is the driver and under the table. Wheel diameters can be smaller without affecting clearance, so band speed can be increased to friction-sawing speeds without problems of centrifugal force in the wheels. Shifting position of the wheel over the table permits angle cutting without shifting the table. Blades can be longer as well, reducing the frequency of replacement.

Induction Welding

INDUCTION HEATING is used in a new, fully automatic, pipe-welding machine developed in France. Surface condition of the metal, thickness irregularities, or edge scale do not affect the quality of the joint. Temperature and time are controlled by photocells and thyratrons. Current 200-kw machines are claimed five times as fast as resistance units, can weld pipe up to 4-in. dia and 21 ft long on conventional longitudinal welding. A 10-in.-capacity unit is under development, working from strip stock.

Trailer Stressed

STRESSED-SKIN construction on special extruded sections features design of a new aluminum trailer body being built by Reynolds. Door frames are also extruded aluminum, with rubber-gasket seals. This, with heavier nose uprights and a 1-piece nose cap, makes operation with cooling units practical. The trailer will be built on a production basis for ten trailer manufacturers forming an association, so is a production-line model which can be fabricated to suit a customer's needs.

Largest

A 200-OZ-CAPACITY injection-molding machine, currently the world's largest, has just been placed in operation by A. L. Hyde Company, Grenlock, N. J. Watson-Stillman built it.

Daffynitions

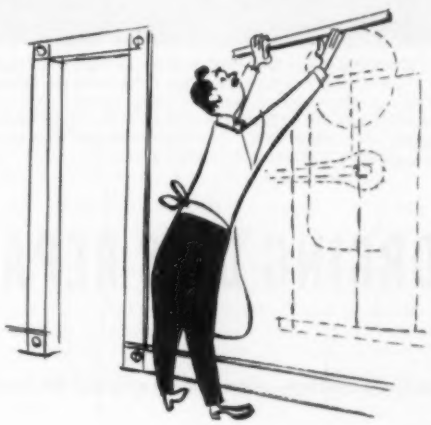
INCLEMENT: where Mr. Atlee's meals go. CHURCH: where we meet nodding acquaintances. STATISTICIAN: worker who puts two and two together, and gets four dollars for doing it. DENTIST: only man who can safely tell a woman to open—and shut—her mouth. E.C.A.: Everybody counts on America. TAXPAYER: Government worker with no holidays, no vacation, and no sick leave. HOOVER REPORT: plum-clearance program. GIRDLE: device for being arresting without being pinched. BARBERSHOP QUARTET: the uncalled for. SOIL: what laundries and farmers make a living from. BRIDGE GAME: war between North and South. CENSUS TAKER: folks living on the facts of the land. PEST CONTROL: business started from scratch. PHILOSOPHER: thinker of $2 thoughts in $10 words. DRUNK: when a man feels sophisticated, but can't pronounce it. JITTERBUG: gal who chews gum and is wrigley all over. MARRIAGE: partnership, with the husband the mute partner. FOLDING MONEY: collapsing currency. TOOTH BRUSH: dental appointment.

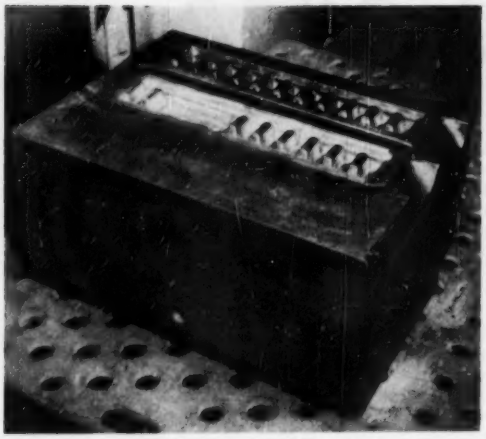
These Drawings Cracked

IT PROBABLY REQUIRES a good many hundred drawings to make a multi-spindle bar machine these days, but the original drawings for the first Acme machine were drawn in pencil on the plastered walls of an old house where Henn & Hakewessell designed and built it.

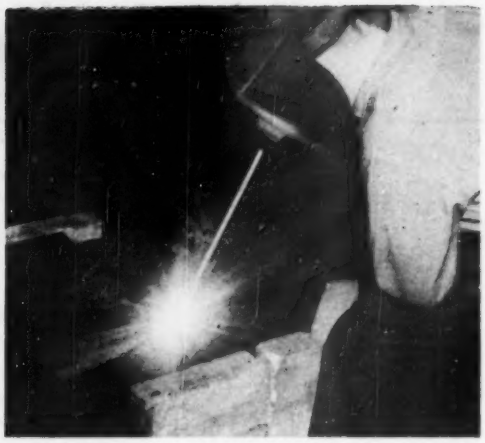
According to Fred H. Chapin, chairman of the board and president of National Acme, in an address to the Newcomen Society, Mr. Henn liked to relate that the vibration of the machinery shook the plaster off the ceiling—and it was a good thing it was not the side walls, or all their engineering details would have been lost.

Incidentally, the first Acme machine was sold to A. O. Schrader & Sons, bike-tire valve manufacturers.



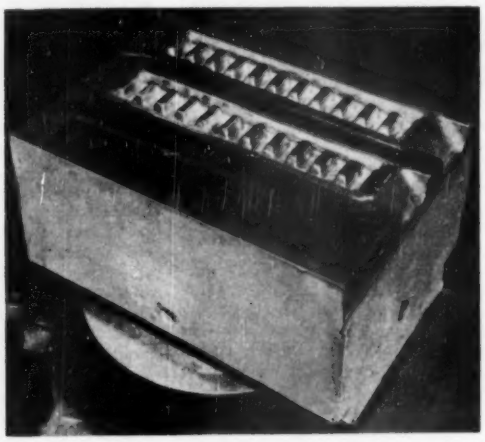


1. **Damaged section** of die is milled out, allowing generous (¼-in. min) radii in all corners. Sharp or confined corners almost always cause failure, while rounded corners permit good weld penetration. Do not attempt welding until every corner is broadly curved on both sides and bottom



2. **Routed block** is preheated to 800 F in an electric furnace, and held for at least 4 hr before welding. Operator lays stringer beads to build up routed area. Chip and clean each pass before the next, to prevent porosity and slag inclusion. Use largest possible electrode with highest possible amperage with a short arc

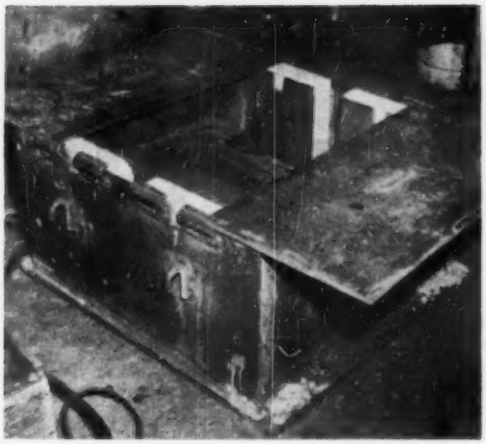
4. **Welded block** is held at 1000 F for at least 5 hr, then cooled slowly in furnace to room temperature before machining. Electrode is selected after laboratory tests of metal deposited on base metal sample matching block analysis. For Finkl FX, electrode selected was low-hydrogen PH No. 21 (AWS-E12016) grade



5. **Machined die,** after repair by welding, is as good as or better than original die. This procedure costs less than a complete resinking operation and does not reduce the size of die block. The repaired die will last at least as long as a new die, and can be rewelded as many times as may be necessary

FORGING DIES REPAIRED BY ARC WELDING

Rebuilt die sections often outlast original die cavities when repair procedure is followed correctly



3. Portable enclosure, lined with firebrick, is used to store heated block when it must lie overnight because welding cannot be finished the same day. When welding cannot be completed at one time, or before block has cooled to 500 F, it must be returned to the furnace and reheated to 800 F, as before

BY FRANK MACHO, Welding Supervisor
HARNISCHFEGER CORPORATION

COST of forging-die maintenance has been cut to the bone in the Harnischfeger forge shop through the development of an arc-welding repair procedure, using low-hydrogen electrodes. It has been proved that with most forging dies this procedure makes old dies as good as new—sometimes better, because rebuilt die sections often far outlast the original ones.

Usually, cracking, checking, or washing out of a forging-die cavity calls for a resinking operation. And even minor product design changes frequently would make this necessary. Not only are such operations expensive, but after several resinkings the die blocks must be discarded because they have become too shallow.

Accompanying illustrations explain the Harnischfeger method of repairing a damaged die block, or making a minor alteration to suit a drawing change. The die is made of Finkl FX die steel, and had produced 7700 gear racks of SAE 1045 steel in a 5000-lb hammer before damage occurred.

Repair by welding and remachining cost $100, resinking would have cost $460. Original cost of the block was $420, first sinking cost $400, so first cost of die was $820.

Assuming that this block was resunk twice after the original sinking and then had to be discarded as too shallow for additional resinking, it would then represent a total investment of $1740, and all that would be left would be the scrap value of the discarded block. With two welding buildups or repairs at $100 each, the total investment is only $1020, and the die block is still as good as new.

SLEEVE-BEARING RESEARCH SHOWS THE BEST STYLE

A RECENT STUDY of sleeve bearings by the National Bureau of Standards resulted in comparative performances of bearings with various ways of admitting lubrication. Five methods of feeding oil through the bearing shells to the bearing surfaces were tried out under controlled conditions. Oil was SAE 20, and was admitted to the bearings at a temperature of 200 F. All test shafts were made of carburized steel, hardened to 55-61 R_c and ground to a surface finish of 4-5 microinches (rms). The bearings were solid-steel sleeves with copper-lead linings pressed into place and machined smooth. Diameters were 2 in., and bearing lengths were 1¼ in.

Tests showed that under exactly the same conditions, a bearing with:

One oil hole (at the unloaded side of the bearing) produced low friction with varying lubrication. This did not provide highest oil flow, but seemed to dissipate heat adequately.

Two oil holes (one on loaded side, one opposite) produced an increase in friction over the bearing with one oil hole because the hole on the loaded side disturbs the normal development of pressure in the bearing. Higher heat was also recorded.

An axial groove (the length of the bearing) provided better oil distribution than the bearing with only one hole. Friction was lower, and heat dissipation was better because of larger oil flow. This kind of bearing would be better for forced oil feeding.

Four holes (spaced 45° apart) performed slightly worse than the two-hole bearing. Friction was similar, but pressure distribution was poorer.

A circumferential groove (a complete circle) produced high friction. Action was like two thin bearings with low lubrication. Oil for this bearing would have to be fed at a high rate. Heat dissipation was poor.

One hole in the shaft (with oil being fed through it to the bearing) produced poor conditions. Oil was shut off when the hole came opposite the area of high pressure in the bearing. Heat dissipation was quite low.

Two holes in the shaft (opposite each other) produced better results than the previous bearing because oil flow and heat dissipation were increased. Friction, however, was also increased.

One hole with flat in shaft (flat at end of oil hole, next to bearing) developed considerable oil turbulence and friction.

Conclusions can be drawn from the comparative results: Sleeve bearings for service installations should preferably be fitted with either a single hole or an axial groove at the location where the least pressure is developed in the bearing shell. This provides best oil flow, the least back-pressure against forced feeding, and the greatest dissipation of heat.

News of Metalworking

McGraw-Hill WORLD NEWS

• **MELBOURNE AUTOMOTIVE** replacement parts firm, Repco Ltd., is setting up two subsidiaries to make drop forgings axles and other car components in collaboration with English and American concerns. Kirkstall-Repco Ltd. (50%-owned by Kirkstall Forge Ltd., Leeds, England) will make heavy front axles and general auto drop forgings. Mechanical Universal Joints Pty. Ltd., (wholly owned by Repco) will make universal joints under agreement with Borg-Warner International Corp., Chicago.

• **MEXICAN** government, in announcing 1950 fiscal year quotas for assembly of passenger cars and trucks, permitted International Harvester Co. to double its production of trucks on condition that the company buy 100,000 bales of Mexican henequen (sisle) for use on binders in U.S. Last year IH had assembly quota of 600 trucks. Now quota is 1250 units.

• **EUROPEAN** manufacturers will be permitted to ship 1300 automotive units to Mexico for assembly in 1950 fiscal year. The importation, all in knockdown shipments, will consist of these makes: Hillman Minx (Brit.) 150; Renault (Fr.), 150; English Ford, 250; Skoda (Czech), 150); Austin, 100; Opel (Germ.), 100; Vauxhall (Brit.), 100; Tatra (Czech), 100; Dyna Panhard (Fr.) 100; and Goliath (Germ.), 100.

• **FORD AUTO WORKS** in Germany will undertake large modernization program, to cost $10-million D-marks. Production of the plants increased 30% in June, with 2604 cars turned out as against 2036 in May.

• **BELGIAN** government has refunded $213,448.52 for seven purchases of electrical sheet steel at prices averaging 26% in excess of U.S. prevailing export prices, ECA announces. Actual excess payment was $44,657 but under ECA law entire purchase becomes ineligible for ECA financing when U.S. market price is exceeded.

Want Defense Work? Here's

DON'T COME TO WASHINGTON! That's the plea of government procurement officers, swamped by businessmen seeking a share of new defense contracts.

• **Go to the field procurement office** in your area. Navy, Army and Air Force have them in every district. All told, there are 55 full-time military procurement offices around the country.

But before you go, have this basic information ready:

(1) What you can make.

(2) A breakdown of tools and facilities, manpower, productive capacity.

(3) Some indication of your capital structure and credit rating. Washington wants to know how heavily you're mortgaged, what kind of insurance you carry, whether you've got enough working capital and credit to handle even a small job.

FIRST TURBO-JET engine designed and built entirely in Canada as a production job is the Avro Orenda, believed to be largest of its type in North America. It will go into production in the A. V. Roe (Canada) Ltd. plant at Malton, Ontario, where a new shop is being made ready with every machine tool brand new. Inspecting engine here are (left to right) Walter N. Deisher, general manager, Avro Canada; Sir Roy Dobson, president, and Leslie Foster

At the procurement office tell the clerk why you're there, what you make. Ask to talk to some technical people to determine what you might be able to make for the government. Then:

(1) Appointment will be arranged for you with engineers who can tell what you can and cannot do in the way of defense production.

(2) You tell your story to these engineers. They'll check your list of machine tools and other equipment. If you've been turning out heavy pots and pans, an Army man might decide your plant was best equipped to make steel helmets; if you make lens frames, an engineer in Navy's Bureau of Aeronautics might decide that you make gage frames for use on aircraft instrument panels. Production rates, approximate price, quality, specifications, etc., will be discussed.

(3) Your name will be listed with companies to be contacted in event Washington advertises for bids on the particular item you're prepared to make. If that item is needed immediately, you might be asked to submit an informal bid right away. But in most cases it's not that simple.

(4) You wait, usually, until Washington sends you an invitation to bid at some future date. This may be an informal request for price and production information preparatory to negotiating a contract, or it may be a formal invitation to bid on an advertised procurement basis.

(5) You reply then, on standard government forms, which are now the same for all three services. If it's an informal request you can answer on your own company letterhead if you wish.

(6) A security check will be made somewhere along the line, to see if your plant can safely manufacture classified items. Government investigators will check your character and that of your workers. They'll look over your plant to see whether you have a fence around it, what its location is, how many guards you employ, whether workers are checked at the gate, etc. One

What You Do

thing to remember: the primary responsibility for security rests with you.

(7) You get the contract, finally, if you're low man, "price and other factors considered." Basically, these other factors are: another engineering check to make sure you can produce the item in the quality and quantity agreed upon, and another check on your financial capacity to handle the order.

That's the routine for contracts let on advertised bid basis, where you'll be competing with anyone who wants to answer the bid. In the case of negotiated contracts, you'll be competing only with those listed or known as possible bidders by military procurement people.

• **NEGOTIATED CONTRACTS** are the big reason for getting yourself listed, for of the $7 billion in extra procurement for defense, 90% will be on a negotiated bid basis. That's because it's faster.

If you get an informal request to quote for a possible negotiated contract and your preliminary answer is satisfactory, you'll be contacted by a contracting officer. He will have some questions about delivery, schedules, profit margin, security, financial capacity, etc., and whether you'll need additional tooling from the government reserve.

These questions settled, you then start negotiating over the type of contract, transportation costs, method of payment, and the like. Once agreement is reached, you get the contract—unless the procurement is cancelled, which is always possible as requirements are continually changing.

In the case of a negotiated contract, you'll be subject to renegotiation later after completion of the contract, to make sure your profit isn't too big. Bid contracts are not subject to this profit-limiting device.

• **For subcontracting,** you deal directly with the prime contractor just as you may now be doing. To find out who is getting the prime contracts, go to the local military procurement office where you will find listed each week all contract awards over $25,000, naming the contractor, the item, quantity, and value. (See listing of major Army ordnance contract awards, below.)

Gov't "How to Sell" Booklets

You can get answers to your more detailed questions on obtaining defense contracts in one or more of the following:

(1) "Follow Me, a Guide for Selling to the Air Force." (Free from Commanding General, Air Materiel Command, Wright Field, Dayton, Ohio.

(2) "Purchased Items and Purchasing Locations," on doing business with the Army. (Free by writing to Army Procurement Information Center, Pentagon, Washington 25, D.C.)

(3) "Selling to the Navy" (15c from Government Printing Office, Washington 25, D.C.)

New Offices Opened

Jones & Lamson Machine Co. has moved its Philadelphia office from Liberty Trust Bldg., Broad & Arch Streets, to 913 Montgomery Avenue, Narberth, a suburb of Philadelphia.

Industrial Filter & Pump Mfg. Co. has moved general offices and plant from 1621 West Carroll Ave. to 5900 Ogden Ave., Chicago.

Robins Conveyors Div., Hewitt-Robins Inc., has moved its Cleveland office from 215 Rockefeller Bldg. to 8905 Lake Ave.

Heppenstall Co., Pittsburgh, has moved its Cleveland district sales office from 311 Rockefeller Bldg. to 506 Terminal Tower Bldg.

Michigan Abrasive Co. has moved to a new and larger plant at 11900 East Eight Mile Road, Detroit.

Sylvania Electric Products Inc., has moved to new headquarters at 1740 Broadway, New York, bringing together divisions and departments in the New York area.

These Firms Got Big Army Jobs

WASHINGTON — Army contracts awarded to private concerns in the month of July have been announced. Some of the major contracts valued at more than $100,000 each are listed here, including some awarded in June.

Davis Aircraft Engineering Inc., Cambridge, Mass., feed mechanisms, $617,066.
Harrington & Richardson Arms Co., Worcester, Mass., 22-cal. survival rifles, $256,462.
Jubilee Mfg. Co., Omaha, auto spare parts, $117,474.
GMC, Truck & Coach Div., Pontiac, Mich., auto spare parts, $196,856.
Saginaw Products Corp., Saginaw, Mich., 1-ton snow trailers, $317,785.
International Harvester Co., Washington, D.C., 5-ton, 4x2 truck-chassis, $368,225.
Corbitt Co., Henderson, N. C., 6-ton, 6x6 truck-chassis for crane mounting, $1,016,724.
Racine Screw Co., Racine, Wisc., 57mm high explosive antitank shells, $124,540.
Highway Steel Products Co., Chicago Heights, aluminum alloy airplane landing mats, $220,500.
Hobart Bros. Co., Troy, Ohio, generator sets, $253,600.
Stewart & Stevenson Services, Houston, generator sets, $106,716.
Randolph Labs, Inc., Chicago, fire extinguishers, $102,188.
Howe Fire Apparatus Co., Anderson, Ind., fire fighting set with truck, pumper type, $203,949.
C-O-Two Fire Equipment Co., Newark, N. J., 5-lb carbon dioxide fire extinguishers, $229,552.
Superior Mfg. Co., Fitchburg, Mass., pinion elevating rear sight assemblies for U.S. rifle, 30 cal., $115,031.
Harrington & Richardson Arms Co., Worcester, Mass., bolt assemblies for 30-cal. BAR., $160,456.
Consolidated Diesel Elec. Corp., Mt. Vernon, N. Y., power units, $440,504.
Wolverine Diesel Power Co., Detroit, power units and spare parts, $625,021.
Anderson-O'Brien Co., Los Angeles, power units and spare parts, $130,442.
Bolinders Co., Inc., New York, power units and spare parts, $762,897.
Utility Electronics Corp., Newark, N. J., radio sets and spare parts, $2,657,909.
Hubbell & Miller Co., New York, radio sets and spare parts, $241,475.
Kelley-Koett Mfg. Co., Covington, Ky., radiacmeter and spare parts, $170,904.
Hallicrafters Co., Chicago, radio terminal sets and spare parts, $305,234.
Tracerlab, Inc., Boston, radiac-training sets and spare parts, $323,330.
Daven Co., Newark, N. J., signal generators and spare parts, $243,859.
George Veron Co., Philadelphia, maintenance equipment and spare parts, $187,180.
Maspeth Tele. & Radio Corp., Brooklyn, teletypewriters, repeater mixers and sub-items, $424,311.
Western Electric Co., Inc., Kearney, N. J., teletypewriter sets, $408,675.
Collins Radio Co., Cedar Rapids, Iowa, diversity rec.-equip., $810,155.
North Electric Mfg. Co., Galion, Ohio, switchboard, $359,751.
Raytheon Mfg. Co., Waltham, Mass., electron tubes, $198,300.
National Union Radio Corp., Orange, N. J., tubes, $160,497.
Peters-Dalton, Inc., Detroit, automatic dishwashing machines, $124,982.
Emeco Corp., Hanover, Pa., metal hospital ward arm chairs, $182,618.
National Enameling & Stamping Co., Granite City, Ill., 5-gallon gasoline drums, $1,146,834.
Renown Stove Co., Owosso, Mich., steel clothes wall locker, $1,148,235.
Stewart-Warner Corp., Indianapolis, personnel heater kits, $291,787.
Perfection Stove Co., Cleveland, power plant heater kits, $288,403.
Kehrig Mfg. Co., Utica, Mich., deep water fording kits, $224,162.
Finchman Co., Philadelphia, instrument cabinets, $102,990.

(*Continued on next page*)

Army Contracts...

United Surgical Supplies, New York, minor surgery, surgical instrument kits, $330,676.

S. Blickman, Inc., Weehawken, N. J., medicine cabinets, $124,757.

Hawk Tool & Engr. Co., Clarkston, Mich., arm & axle shaft tracks, $173,508.

Vulcan-Hart Mfg. Co., Louisville, Ky., oil-burning ranges, $1,633,202.

Shaw-Walker Co., Muskegon, Mich., insulated steel filing cabinets, $125,473.

Utility Electronics, Newark, N. J., radio sets, $578,346.

Hallicrafters Co., Chicago, radio relay sets and test oscillators, $124,707.

Radio Corp. of Amer., Camden, N. J., radio receiver assy, receiver monitors, power supply, $134,942.

Jacobsen Mfg. Co., Racine, Wisc., power units, $131,711.

Telectro Industries Co., Long Island, N. Y., auxiliary interphone eqpt., $192,853.

Federal Mfg. & Engr. Corp., Brooklyn, N. Y., radio receivers, $557,517.

Vulcan Steel Products Co., Brooklyn, N. Y., radio sets, $232,061.

Transmitter Equip. Co. New York, radio terminal sets, $857,147.

Benrus Watch Co., Waterbury, Conn., plungers, body assembly for delay plungers, $217,377.

Russakov Can Co., Chicago, drums, flammable liquid, steel, 5-gal., $1,454,375.

Versatile Engineering & Mfg. Co., Dearborn, Mich., automotive parts, $159,060.

Biederman Motors Corp., Cincinnati, auto spare parts, $338,271.

Chrysler Corp., Detroit, auto spare parts, $1,133,112.

Revere Copper & Brass Inc., Detroit, auto spare parts, $140,834.

International Harvester Co., Detroit, auto spare parts, $620,317.

Republic Steel Corp., Bolt & Nut Div., Cleveland, auto spare parts, $157,739.

Joseph Weidenhoff, Inc., Chicago, tools and equipment, $178,828.

White Motor Co., Cleveland, trucks, 5 ton, 4x2, tractors, $205,534.

Truck & Coach Div., GMC, Pontiac, Mich., trucks, 2½ ton, 4x3, tractor and dump, $1,165,472.

Trico Products Corp., Buffalo, auto spare parts, $177,517.

Willys-Overland Motors Inc., Toledo, auto spare parts, $780,936.

Ainsworth Mfg. Corp., Detroit, auto spare parts, $100,310.

Ueber Tool & Mfg. Co., East Detroit, auto spare parts, $100,310.

Federal Motor Truck Co., Detroit, auto spare parts, $1,017,725.

Firestone Industrial Products Co., Akron, auto spare parts, $1,490,215.

The Goodyear Tire & Rubber Co Inc., Akron, auto spare parts, $1,377,530.

Republic Steel Corp., Bolt & Nut Div., Cleveland, auto spare parts, $151,533.

Lamson & Sessions Co., Cleveland, auto spare parts, $253,355.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., auto spare parts, $118,289.

Creative Metals Co., Emeryville, Calif., tools and equipment, $100,856.

D. W. Onan & Sons Inc., Minneapolis, tools and equipment, $115,472.

Dorsey Trailers Inc., Elba, Ala., 6-ton, semi-trailer 2W, van, $436,167.

General Electric Co. Syracuse, radio sets, $1,340,366.

Specialty Assembling & Packing Co. Inc., Brooklyn, public address sets, microphones, speakers, $516,353.

Barker & Williamson Inc., Bristol, Pa., radio sets, receivers, control units, dual diversity convertors, $6,130,122.

Radio Corp. of America (RCA Victor Div.), Camden, N. J., mobile television system and spare parts, $192,871.

Kellogg Switchboard & Supply Co., Chicago, telegraph terminals, $422,591.

Continental Electronics Ltd., Brooklyn, rad teletype term., $826,875.

Munston Mfg. & Service Inc., New York, test equipment and spare parts, $255,911.

Gemco Engineering & Mfg. Co., Cincinnati, steel wire mesh pallet, $110,246.

Gibson Mfg. Corp., Longmont, Colo., dummy rocket fuse, $168,192.

Cans Inc., Chicago, ammunition containers, $189,936.

International Spare Parts Corp., Long Island City, N. Y., spare parts for generating units, $194,885.

LATEST HARDINGE general purpose lathe with separately powered carriage is demonstrated by W. C. Haskins as A. V. Nicolle (right), managing director of Hardinge Machine Tools, Ltd., England, and D. R. Laux (left), vice president and sales manager of Hardinge Brothers, Inc., Elmira, N. Y., look on. Mr. Nicolle recently visited the U.S. to study currrent management and manufacturing methods.

Western Electric Co. Inc., Winston-Salem, N. C., parts for electrical directors and tooling, $398,980.

National Can Corp., New York, ammunition packing cans, $438,280.

Biederman Motors Corp., Cincinnati, automotive parts, $249,254.

Milwaukee Gear Co., Milwaukee, automotive parts, $116,634.

American Steel Dredge Co. Inc., Fort Wayne, cranes, $179,545.

Lofstrand Co., Rockville, Md., water fire extinguishers, $197,333.

United Auto Parts Co. Inc., Kansas City, automotive parts, $158,415.

Stewart Truck Bodies, Inc., Brooklyn, conversion and rebuilding of trailers, $158,915.

Auto-Soler Co., Atlanta, mechanical parts of misc. fire control equip. and tooling therefor, $346,564.

Lewyt Corp., Brooklyn, radio receivers, rectifiers, amplifiers, power supply, etc., $12,527,143.

University Loudspeakers, Inc., White Plains, N. Y., loudspeakers, dynamic, $160,380.

Mercury Electric Corp., Kansas City, test sets, $199,252.

Espey Mfg. Co., Inc., New York, transmitters, control units, mountings, $2,855,400.

General Electric Co., Schenectady, electron tubes, $268,800.

Empire Corporation, Milwaukee, power units, $1,290,548.

Raytheon Mfg. Co., Waltham, Mass., receivers, transmitters, amplifiers, tubes, $3,501,662.

Wind Turbine Co. West Chester, Pa., towers, $104,442.

The Daven Co., Newark, N. J., tube testers, $234,825.

Radio Receptor Co., Inc., Brooklyn, amplifier assembly, antenna tuning units, $159,102.

M. C. Jones Electronics Co., Bristol, Conn., radio frequency watt meters, $321,248.

Joseph J. Bredemann, Chicago, tool equipment, cost for export packing, $121,525.

Caroled Co., Inc., New York, cable assemblies, $376,075.

Motorsearch Company, Racine, Wisc., power units, $303,337.

Hubbell & Miller Co., Brooklyn, N. Y., sound locating sets, $530,743.

Times Facsimile Corp., N. Y., facsimile sets, $252,860.

Garod Radio Corp., Brooklyn, controls, $548,189.

Rauland-Borg Corp., Chicago, power supply, $3,196,635.

Utility Electronics Corp., Newark, N. J., power supply, $401,484.

Siltronic Company, Pittsburgh, Pa., control boxes, $671,384.

Specialty Assem. & Pack. Company, Inc., Brooklyn, radio sets, $405,623.

Telegraph Apparatus Co., Inc., Chicago, mountings, $1,316,599.

R. K. LeBlond Machine Tool Co., Cincinnati, tools and equipment, $238,893.

Joseph Weidenhoff, Inc., Chicago, tools and equipment, $602,156.

Sheldon Machine Co., Inc., Chicago, tools and equipment, $219,403.

Hobart Brothers Co., Troy, Ohio, tools and equipment, $130,800.

D. W. Onan & Sons, Inc., Minneapolis, tools and equipment, $458,407.

American Finishing Co., Memphis, auto spare parts, $153,670.

Electric Auto-Lite Co., Toledo, auto spare parts, $115,951.

Watson Automotive Equipment Co., Washington, D.C., ambulances, $188,710.

Fargo Motor Corp., Detroit, Mich., trucks, $125,477.

Merz Engineering Co., New York, field chests, dies and molds for fabrication of chests, $496,020.

Masterfreeze Corp., Sturgeon Bay, Wisc., prefabricated sectional refrigerators, $536,185.

Bendix Aviation Corp., South Bend, Ind., automotive parts and supplies, $194,008.

Diamond T. Motor Car Co., Chicago, Ill., automotive parts and supplies, $274,005.

Willys-Overland Motors, Toledo, Ohio, automotive parts and supplies, $102,402.

Mechanical Equipment Co., New Orleans, distillation units, diesel driven, $418,988.

Schield Bantam Co., Waverly, Iowa, crane shovels, $951,115.

Firestone Tire & Rubber Co. Akron, rifles and spare parts, $347,432.

Litton Industries, San Carlos, Calif., magnetrons, continuous wave; electromagnets, $121,500.

Pullman-Standard Car Mfg. Co., Chicago, Ill., new design railway boxcars, $500,495.

Major Air Force Awards

Republic Aviation Corp., Farmingdale, N. Y., spare parts for aircraft, $997,095.

Ryan Aeronautical Co., San Diego, spare parts for aircraft, $375,558.

Sikorsky Aircraft Div., United Aircraft Corp., Bridgeport, Conn., spare parts for aircraft, $277,000.

Star Electric Motor Co., Bloomfield, N. J., powerplants and spare parts, $469,813.

Sundstrand Machine Tool Co., Rockford, Ill., spare parts and/or subassemblies for constant speed drives, $427,574.

Texas Engrg. & Mfg. Co., Dallas, reconditioning of aircraft, $260,000; fabrication and erection of maintenance docks and data, $586,008.

Lockheed Aircraft Corp., Burbank, Calif., spare parts for aircraft, $485,238.

Lycoming Div., Avco Mfg. Corp., Williamsport, Pa., aircraft powerplants, $3,887,743.

North American Aviation, Inc., Los Angeles, model F-95A airplanes and related equipment, $64,337,847; spare parts for aircraft, $1,510,450.

NEW NAVY ATTACK BOMBER, turbo-prop-driven Douglas XA2D Skyshark, successfully completed its first test flight at Edwards Air Force Base, Muroc, Calif., recently. It is powered by T-40 Allison twin turbo-prop engine driving two Aeroproducts counter-rotation propellers. This power is augmented by jet thrust through tail pipe. Once plane is airborne, either of turbines may be cut off to gain greater flight endurance

Allocations, Priorities, Will Soon Affect Your Business

WASHINGTON — You are going to be doing business under government controls within a month.

Congress is moving at top speed to give Mr. Truman the war powers he asked for last month. There will be a law on his desk early this month.

Once signed, you can expect regulatory orders to start flowing out of Washington overnight.

Federal Reserve Board would control credit, Interior would get electric power and all fuels, and Commerce would get about everything else, including transportation.

To do the job, Commerce will set up a new unit to be called something like "Bureau of Industry Operation." (The word "controls," of course, will be taboo.) It will be built around a nucleus of present Commerce experts, plus a corps of newly recruited dollar-a-year men.

Secretary Sawyer laid out where the controls will hit first — steel, tin, copper, aluminum. Users can expect full use of the war power to control these critical metals. In almost one-two-three fashion you can expect:

- **Inventory limitation** — holding you to no more than perhaps 45 days' supply. At the same time, FRB will re-impose Regulation W. Both these steps can be taken immediately without setting up any elaborate machinery.
- **Limitation orders** — Restricting the use of tin in cans, for instance, or copper in kitchen utensils.
- **Priorities for military orders** in the works — as soon as the paper work can be organized. Then priorities for new weapons and equipment, as the Pentagon decides on what it wants. Then priorities for essential civilian equipment, like freight cars or power generators.
- **Allocations** — rationing the manufacturer — will probably come last, because it practically takes a War Production Board to operate them. Here's where you get the percentage cutbacks that would bring auto output down to maybe 5 million per year, step-by-step over a six-month period. Of course, if things get tough enough, the cutbacks will go all the way to 100% — an outright ban on non-essential civilian production.

OBITUARIES

C. N. Safford, president of Lovejoy Tool Co., Inc., Springfield, Vt., died July 23, following a three weeks' illness caused by a heart attack.

Edward L. Gann, 58, of Hanson-Van Winkle-Munning Co., Matawan, N. J., died June 30.

Herbert C. Jarvis, 68, retired chief mechanical engineer for Pacific Car & Foundry Co., Seattle, died July 18.

Louis W. Rawson, 79, consulting engineer, Washburn Shops, Worcester Polytechnic Institute, died in Worcester July 12.

Huge Steel Expansion Planned

• Increases in steelmaking capacity in the United States in the first six months of 1950 and in prospect for completion by the end of 1952 will total 6,363,000 tons, making one of the largest expansion programs ever undertaken by the steel companies of this country, it has been announced by American Iron & Steel Institute. Total capacity at the end of 1952 is expected to reach 105,750,000 tons.

New Weldment Division

• For the first time in its 40-odd year history, Continental Foundry & Machine Co., East Chicago, has entered commercial weldery as an adjunct to its steel foundry production and manufacture of complete rolling mills, heavy machinery and iron and steel rolls. The firm's new Weldment Division has opened with a complete steel fabricating shop with a well-equipped welding department capable of handling any type of welding, almost without size limit.

Report on Plastics Supply

• The Society of the Plastics Industry presents this picture of the plastic supply situation as industry girds for defense production: Not overly abundant are polystyrene, phenolics, and nylon, because of dependence on benzene, which must be imported. Supplies of acrylics, cellulosics, melamines, ureas, vinyls are considered adequate. Polyethylene plant capacity is limited now, but can be increased. Civilian supplies might be short for a while.

Tax Policy Statement Made

• Machinery and Allied Products Institute, in a statement presented to the Senate Finance Committee July 10, made these five recommendations on tax policy: (1) There should be no net increase in corporate tax rates; (2) there should be no change in treatment of gains and losses arising from sale of plant and equipment; (3) the carryback of losses should be extended to three years, not reduced to one; (4) federal depreciation policy should be reformed to restore to business management reasonable discretion in this field; and (5) the proposed change in interest rates on refunds should be rejected.

Machine Tool Shipments in '49 Valued At $241 Million, Down 13% from '48

WASHINGTON—Machine tools valued at $241 million were shipped by 349 companies during 1949, according to the Bureau of the Census, Dept. of Commerce. This represents a decline of 13% from value of shipments of machine tools in 1948.

Total value of lathes shipped during 1949 amounted to over $62 million; grinding and polishing machines $46 million; and milling machines $31 million. These three major types of machine tools accounted for 58% of the total value of machine tools shipped during 1949.

In 1949, over 85% of the total value of all machine tools shipped was accounted for by companies located in the New England and East North Central States. Ohio ranked first with $82 million, one-third of the U.S. total, and the five East North Central states—Ohio, Indiana, Illinois, Michigan, and Wisconsin—accounted for over 60% of the U.S. total. Machine tools were produced in 25 states during 1949.

	Shipments		
	No. of Firms	No. of Items	Value (thous. dollars)
Boring machines	39	1,213	$29,430
Horizontal-boring, drilling, and milling machines			
Table-type	11	232	7,037
Floor-type and all other	9	47	2,816
Vertical-boring and turning mills	8	275	9,410
Precision-boring machines	7	435	6,575
Jig-boring machines	7	155	1,481
All other boring machines	10	85	2,141
Broaching machines	6	290	3,411
Internal-broaching machines, horizontal and vertical	4	165	1,260
Surface-broaching machines, single and double-ram and rotary	6	93	1,330
All other broaching machines	4	32	821
Centering machines	7	59	332
Drilling machines	54	6,305	25,271
Sensitive drilling machines			
Bench-type	10	1,457*	33
Floor and pedestal-types (including light-industrial types)	10	2,517*	2,416
Vertical (upright) drilling machines			
Standard single-spindle	7	731	856
Heavy-duty	5	97	423
Gang drills	3	77	197
Radial-drilling machines			
Plain			
Under 13" column	6	284	1,672
13" column and over	7	233	2,739
Multi-spindle drilling machines, way and special types	23	756	14,978
Deep-hole drilling machines, horizontal and vertical	5	25	402
All other drilling machines	15	128	1,255
Gear-cutting and finishing machines	19	1,095	14,231
Gear-hobbing machines	8	345	4,136
Gear shapers, cutters (including planer-type), and generators	8	560	7,799
Gear-finishing machines (including gear tooth-grinding, honing, lapping, polishing, and buffing machines)	9	170	1,896
Grinding and polishing machines (except gear tooth-grinding, honing, lapping, polishing, and buffing machines)	128	64,257	45,660
External cylindrical-grinding machines			
Plain	6	333	5,412
Universal	9	217	1,807
Roll grinders	5	43	3,607
Crankshaft grinders	4	177	1,348
All other external cylindrical-grinding machines	7	99	810
Internal cylindrical-grinding machines			
Plain and chucking-type	10	328	4,765
All other			
Surface-grinding machines			
Rotary table-type, horizontal and vertical	12	745	2,357
Reciprocating table-type, horizontal and vertical-spindle	17	1,209	4,855
All other surface-grinding machines (including planer-type)	8	134	529
Bench grinders	19	43,999	2,472
Floor and snag grinders			
Average value less than $190	9	1,984	363
Average value $500 and over	8	1,408	871
Tool and cutter-grinding machines			
Universal			
Average value under $1,000	5	287	141
Average value $1,000 and over	15	795	2,421
Special (including light-industrial types	21	1,238	1,907
Honing and lapping machines (except gear-honing and gear-lapping)	9	154	1,811
Polishing and buffing machines (including bench and floor-types)	24	2,073	2,814
All other grinding machines	41	9,034	7,870
Lathes	82	18,631	62,289
Bench lathes (except bench turret lathes)			
Average value under $500	11	6,707	1,717
Average value $500 and over	6	230	446
Engine lathes (manufacturing and tool-room lathes)			
Up to and including 16" swing			
Average value under $2,000	5	3,975	3,077
Average value $2,000 and over	20	1,876	9,461
17"-23" swing (inclusive)	18	944	5,591
24"-36" swing (inclusive)	12	320	5,212
Over 36" swing	6	24	1,952
Gap lathes	5	63	419
Speed lathes	6	445	206
Turret lathes (except vertical turret lathes)			
Bench-type	6	125	184
Ram-type			
Up to and including 1"	5	145	482
Over 1"	8	400	3,274
Saddle-type	6	241	3,601
Automatic chucking lathes			
Single-spindle	5	154	2,126
Multi-spindle	10	193	5,012
Automatic between-center lathes	8	294	2,598
Automatic-screw (bar) machines	10	1,081	10,373
All other lathes	24	1,518	6,658
Milling machines	56	4,397	31,400
Bench and hand-milling machines			
Average value $500 and over	11	490	889
Knee-type milling machines (except bench-type)			
Horizontal plain	13	570	4,373
Horizontal universal	7	497	3,955
Vertical	10	1,476	4,180
Bed-type milling machines			
Single-spindle	7	305	3,244
Double-spindle and special-purpose machines	15	199	5,357
Planer-type milling machines	4	34	2,768
Profiling machines, duplicators, and die-sinking machines	8	217	3,720
Thread-milling machines	7	38	542
All other milling machines	18	571	2,372
Planers	5	99	3,699
Double-housing	4	51	2,289
Openside	5	48	1,410
Shapers (except gear shapers)	12	666	2,831
Horizontal crank-type	10	596	2,279
Under 20" stroke	10	270	826
20"-27" stroke (inclusive)	8	262	1,111
28" stroke and over	6	64	342
All other shapers	4	70	552
Keyseating machines	5	235	410
Sawing and cutoff machines	36	5,594	3,464
Contour sawing and filing machines (including band saws)	12	4,105	2,823
Tapping machines	22	454	1,844
Threading machines (except thread milling machines and thread-grinding machines)	20	8,336	6,065
Pipe threading	13	7,867	3,751
Other threading machines (including bolt-threading)	8	469	2,314
All other machine tools**	38	—	8,210

* Number of spindles.

** Includes planers other than double-housing and openside; rifle-working machines; chamfering machines; facing machines; automatic-roller cutoff machines; special-drilling and tapping machines; horizontal-processing machines; special-transfer machines; special cylinder-block facing machines; special axle-cutoff and centering machines; special axle-end facing machines; and other specially designed machine tools involving combinations of two or more processes, such as boring, reaming, drilling, facing, turning, and counterboring.

John Ernst

Charles W. Bryan, Jr.

R. C. Kinley

Beaman H. Ayers

Names in the News

John Ernst has been named general works manager, Tractor Div., Allis-Chalmers Mfg. Co., Milwaukee, succeeding **Hugo W. Liebert,** retired after 43 years with the company. Mr. Ernst joined the company 33 years ago, serving his apprenticeship as a tool and die maker. Until his appointment he was assistant general works manager of all tractor plants.

Everett M. Hicks has been named manager, Grinding Machine Div., Norton Co., Worcester, Mass. **Walter G. Johnson** was named manager of research and engineering of the division, succeeding **Albert G. Belden,** retired after 38 years. Mr. Hicks, assistant manager of the division since 1947, assumes managerial duties of **Frank W. Smith,** vice president and former manager, so that the latter can devote full time to policy making duties as vice president in charge of the division. Mr. Johnson was assistant chief engineer of the division. Mr. Belden had served as engineer, and works manager, and was directly responsible for over 30 patents during his career with Norton.

Charles W. Bryan, Jr., has been elected president, Pullman-Standard Car Mfg. Co., subsidiary of Pullman Inc., Chicago. He was formerly vice president and general manager of Federal Shipbuilding & Dry Dock Co.

Oscar S. Swanson, superintendent of the Cleveland plant of Truscon Steel Co., has been named works manager of the Niles Steel Products Div., Republic Steel Corp. **Frank F. Malcher,** works accountant for the Pressed Steel Div., replaces Mr. Swanson at the Cleveland plant, and **J. Carl Reik** succeeds Mr. Malcher as works accountant for the division. **J. J. Parks,** superintendent of the Elyria plant of Republic's Steel & Tubes Div., has retired, being succeeded by **Herbert J. Meyfarth,** assistant plant superintendent of the Steel & Tubes Div., Cleveland plant.

M. P. deBlumenthal has been named assistant chief research engineer, Studebaker Corp., South Bend, Ind. **T. A. Scherger** has been named chief powerplant engineer, and **T. E. Wagar** has been named chief electrical engineer.

Beaman H. Ayers has been named vice president and works manager of National Acme Co., Cleveland, succeeding **R. C. Kinley,** retired after 47 years of service. Previous to being named vice president in 1940, Mr. Kinley had served as a machinist, inspector, superintendent of the screw products division, sales engineer and general superintendent. Mr. Ayers has been general superintendent since 1940, in which position he is now succeeded by **John L. Molner,** since 1945 manager of the No. 2 plant, Contract Mfg. Div. Mr. Kinley will continue to serve in a consulting capacity.

Kenneth R. Beardslee has been named president, Carboloy Co., Inc., Detroit, succeeding the late **Walter G. Robbins. Eugene F. Wambold,** formerly vice president in charge of manufacturing, was named to the newly created post of executive vice president in charge of manufacturing, engineering, employee and community relations, and purchasing. Mr. Beardslee was formerly vice president and marketing manager. Both men have been named to the board of directors. Mr. Beardslee is a past-president, American Supply & Machinery Manufacturers' Assn.

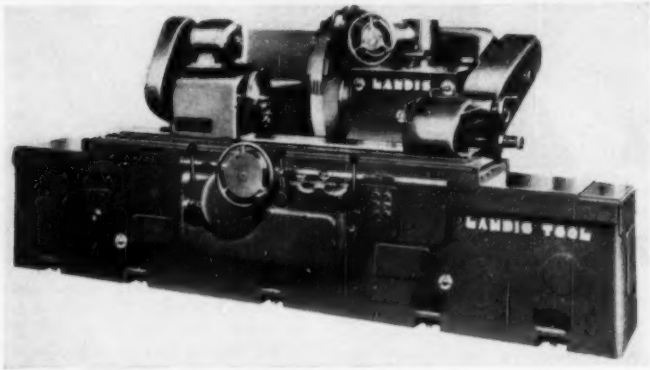
Everett M. Hicks

Walter G. Johnson

Albert G. Belden

Kenneth R. Beardslee

New Shop Equipment



Landis Plain Cylindrical Grinder Designed With Heavy Bed

A heavy bed, telescoping covers, and changed operating controls and lubrication methods are among the improvements claimed by Landis Tool in a line of 10- and 14-in. plain and semi-automatic grinding machines.

Bed is designed to preserve the alignment of the hand-scraped ways and provide a rigid foundation for the operating portions of the machine. Reservoirs for hydraulic oil, lubricating oil and coolant are all part of this casting. Lubrication of the ways is by pressure. A filter and safety pressure switch is part of this system. In the event of a drop in pressure in the lubricating lines, the pressure switch will operate to stop the machine, thus protecting the ways. Pockets for bed leveling by means of jack screws are cast into the bed.

Telescoping covers are provided to protect the carriage ways. A swivel table permits the grinding of tapered work. The traverse is hydraulically operated by a twin-cylinder system. and its speed ranges from 3 to 240 ipm. Tarry control for traverse grinding operation is variable and may be quickly adjusted at the front of the machine. The two-speed hand traverse has a fast speed for setup and a slow speed for grinding up to shoulders.

The electrical installation uses oil- and waterproof pushbuttons. The controls are mounted in a dust- and moisture-tight cabinet, which is mounted high so that it can be serviced from a standing position.

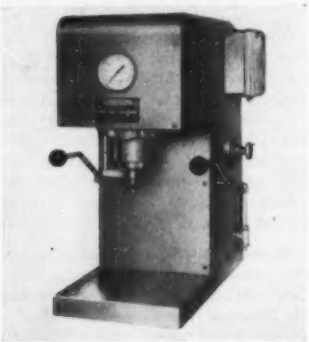
Support bearings for the grinding wheel spindle are babbitt lined, steel backed, and constructed of one piece. They are adjustable for clearance between spindle and bearing. Bearing lubricant is carried in a separate reservoir in the wheel-base casting.

Headstock spindles, wheel feed, and hand traverse all use anti-friction bearings. The wheel feed can be operated either coarse or fine. A hydraulically operated slow grinding feed for traverse grinding operations feeds at each or either reversal point, and is adjustable for both rate and amount. Rapid hydraulic infeed is available and can be made to operate in conjunction with either traverse grinding or plunge grinding. For semi-automatic plunge grinding operations, a timer may be supplied so that the operator will only have to load and unload the workpieces.

Extra equipment which is available for speeding production and adapting the machine to special grinding operations includes angular wheelheads for grinding face and diameter in one operation, automatic sizing, and an overhead wheel-base mounted, hydraulically operated wheel dresser. Wheels can be dressed either straight or with a profile. Also available are reciprocating wheel spindle, live spindle headstock, shoulder grinding attachment and extra-length hydraulic infeed.

Lengths between centers of 18, 36, 48, 72, 96, and 120 in. are available. The machine is intended to be used for medium-weight work and includes straight cylindrical, taper, shoulder, and with extra equipment, profile and angular grinding.

Landis Tool Co., Waynesboro, Pa.
(MORE DATA? CIRCLE FYI 31, p. 147)



Bench Press Is Hydraulically Operated

Hannifin Corp. has added a hydraulic "Han-D-Press," available as the F-10 (1-ton) or as the F-20 (2-ton). Developed to meet the need for a fast-acting, precision unit to speed up light production operations, such as staking, marking, broaching, punching, riveting and press-assembly, the press can be used where compressed air is not available.

Mechanical, dual controls are standard, and tamper-proof. In event an operator ties down either control (so as to operate the press with one hand) the ram will advance on the first stroke thereafter but will not return, making it impossible to complete the cycle. The same feature makes it possible to "inch" the ram to any desired position and hold it there during setup work. A 1½-hp, 1800-rpm motor operates a 3.3 gpm pump.

The stroke is 6 in., gap 10 in., and reach 6 in. Complete unit, including base, weighs less than 500 lb.

Hannifin Corp., 1118 So. Kilbourn Ave., Chicago 24, Ill.
(MORE DATA? CIRCLE FYI 32, p. 147)

Materials and Parts

Die Grinder Surfaces High-Speed Steel and Carbide Dies

Pratt & Whitney has developed a grinder which is designed for facing new die blocks, reconditioning dulled impression edges, and preparing worn dies for resinking, as well as being equally suitable for regular surface grinding. The machine is built in two sizes for table capacities of 16x24 in. and 36x42 in.

Operating like a vertical profiler, it finishes flats around irregular reliefs, and does precision step grinding. 1½- to 2-micro-inch surface finishes are produced without need for subsequent lapping or polishing and with minimum breakdown of cutting edges. Sufficient clearance is provided to permit grinding between die pins on blanking-punch and die halves, thus saving assembly time in resurfacing worn dies.

The machine consists of a rigidly constructed bed on which a hydraulically operated table reciprocates. A rail, supported by two uprights to the bed, carries a vertical spindle which can be moved cross ways by a sensitive wheel. The ,16x 24-in. machine accommodates 3- and 5-in.-diameter cup wheels, and 10-in.-diameter ring wheels are used on the 36x42-in. machine. A constant flood of coolant is supplied through the center of the spindle to the inside of the wheel and through an auxiliary line to the outside of the wheel. Guards enclose the table and confine the spray thrown by the wheel.

The 16x24-in. grinder is equipped with three spindle-speed changes which adapt the machine for grinding carbide or tough die steels. The speeds are especially suited for 3- and 5-in.-diameter grit-cup wheels and diamond-cup wheels. The table hydraulic drive has a variable feed range from 1 to 20 fpm.

A 36x42-in. grinder accommodates the larger sizes of blanking-punch and forging dies. A 10-in. ring wheel is used in this machine with a spindle speed of 1750 rpm. Hydraulic-power table feeds range from 1 to 40 fpm.

Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, 1, Conn.

(MORE DATA? CIRCLE FYI 33, p. 147)

... INCLUDING

Engine lathe has extra-wide gears that are always in mesh. Gearbox is totally enclosed.....page 142

Duplicator reproduces exact contours of forming dies and models on paper .....page 143

Electronic timer provides automatic control of operation, limit and sequence timing....page 144

Vise provides four planes of adjustment, allowing tool to be held at any angle.....page 145

Oven with vibratory spiral conveyor heats plastics by infra-red heat .....page 152

Plastic with the properties of high strength and toughness developed for gears.....page 154

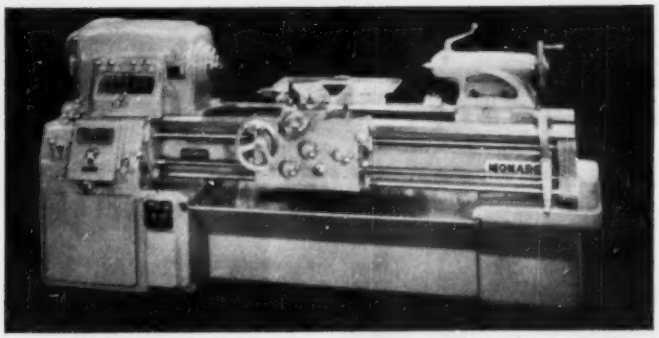
Pulley with a centrifugally operated clutch is controlled by engine speed.....page 158

New Bulletins for your Shop Library, including a 23-page catalog covering a large variety of collet chucks..pages 147 and 148

...and in August 21

Rotary-fixture machine will bend irregular shapes or true radii in tubing, bars, extrusions, or roll-form sections up to 8-in. wide.

Fire-protection system makes use of the photoelectric principle to detect fires. Detector ignores extraneous light.



Extra-Wide Gears are Always Meshed In Monarch 60 Lathes

A number of refinements in design and construction have been incorporated in a Series 60 line of engine and toolmaker's lathes by Monarch Machine Tool. Headstock gears are of helical form and are made of hardened-alloy steel with ground or shaved tooth contours. Due to the extra width of the gear teeth more tooth contact than normally possible is obtained, resulting in a more efficient transmission of power.

Speed changes are readily made by sliding heavy-sided jaw clutches. Since the gears are always in mesh, shock and wear are reduced. An American-Standard D-1 Camlock spindle nose assures rigid mounting and quick, easy interchangeability of chucks, plates and fixtures.

Both the gearbox and gearing are totally enclosed, thereby eliminating accidental entry of foreign matter. Automatic pressure lubrication is provided not only to the gearbox and end gearing, but also to the headstock, apron, carriage bearing on the ways, and compound bottom slide on the carriage. All bearings are of the anti-friction type.

Tailstock of the toolmaker's lathe is of the quick-clamping type, and the spindle is provided with a tang slot and a graduated scale. Leadscrew reverse is operated by a lever at the side of the apron, particularly advantageous when a large amount of thread chasing must be done. Stops on the reverse rod provide close control in both directions of carriage travel, either when threading or feeding.

Depending upon the size, these lathes may be equipped with one of several methods of tracer duplication: air-gage tracer, Motor-Trace, or Monarch-Keller controls.

All Series 60 engine and toolmaker's lathes are suited for work based on the metric measurement system. Transposing end gears are available for use in connection with the standard English box, which provides pitches in millimeters and feeds in inches. These machines may be supplied on order with a metric gearbox having a wide range of both pitches and feeds in millimeters. Furthering the range of usefulness of the Series 60 line, English transposing gears are obtainable for use in connection with the metric gearbox, in which case threads are in inches and feeds are in millimeters. Module transposing gears may also be secured.

Monarch Machine Tool Co., Sidney, Ohio

(MORE DATA? CIRCLE FYI 34, p. 147)

Magnetic-Particle Clutch For Commercial Use

First developed for the Navy in the operation of shipboard equipment such as radar and sonar, magnetic-particle clutches are currently in production for industrial use.

Called the Magneclutch, the coupling utilizes the action of a dry magnetic mixture in a magnetic field to link driving and driven parts. The magnetic mixture is composed of iron particles and flake graphite. The field is established by current flowing through a coil, and by varying the current the degree of clutching can be controlled.

Design and operating advantages claimed for the clutch include: small control power with extremely fast response, no wear on torque-transmitting surfaces, torque at zero slip, large maximum to minimum torque ratio, and easy adaptation to remote control.

Vickers Electric Div., Vickers, Inc., 1815 Locust St., St. Louis, Mo.

(MORE DATA? CIRCLE FYI 35, p. 147)

Oil-Laden Air Cleaned by Vapor Collector

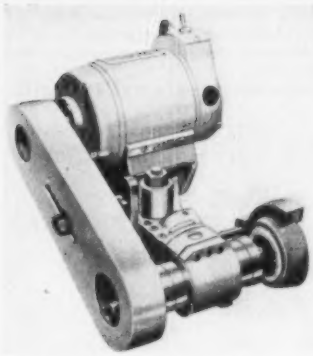
This motor-driven attachment removes the particles of oil from mist emanating around machines engaged in high-speed machining operations where oil is used as a coolant. Some of the operations the unit is used with are thread grinding, carbide-tool grinding, formed-wheel grinding, operations where oil is used as a coolant, high-speed turning and many automatic screw-machine operations.

The attachment consists of a motor-driven fan mounted on a dispersing tank. Oil-laden air is blown into the tank where it disperses in an expansion chamber so that it slowly spreads over the whole area of the three outlet filters. In these filters the oil is collected on the renewable filter pads where it drains to the base of the tank. A drain-cock provides for removing oil for re-use.

The fan is driven by a ¼-hp flange-type, totally enclosed motor controlled by a starting switch having overload protection. Provision is made for either setting the attachment on the floor or suspending it from the ceiling.

Brown & Sharpe Mfg. Co., Providence 1, R. I.

(MORE DATA? CIRCLE FYI 36, p. 147)



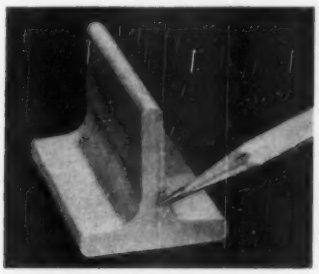
Precision Grinder Adaptable To Most Machine Tools

A toolpost and thread grinder has been developed for external, internal, surface and thread grinding production jobs which can be used on most standard machine tools having a T-slot mount. Accuracy to tolerances as close as 0.0001 in. are claimed for the machine.

A ⅝-hp ac-dc motor is standard for 115 or 230 volts. Spindle speeds are from 5000 to 32,000 rpm.

K. O. Lee Co., Aberdeen, South Dakota

(MORE DATA? CIRCLE FYI 37, p. 147)



Inconel Available in Standard-Size T-Sections

Hot rolled Inconel is available in equal T-sections to manufacturers of furnaces and other high-temperature equipment. It is claimed the ready-made and uniform structural parts will effect considerable economy over the cost of fabricating the parts in company shops. The section can be joined in any way.

The T-sections are made in a standard 1½x1½x1¼ in. size, and in lengths up to 15 ft. The weight is approximately 2¾ lb per ft. They can be produced in nickel and Monel where tonnage demands are sufficiently high in the standard sizes.

International Nickel Co., 67 Wall St., New York 5, N. Y.

(MORE DATA? CIRCLE FYI 38, p. 147)

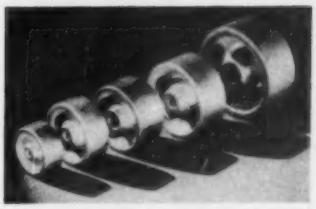
Pneumatic Vibrator Delivers Up to 6000 Impacts per Min

Operating on standard 80-psi air-line pressure, Spo Series 76 vibrators deliver from 2200 to 6000 impacts per min, depending upon piston diameter. Speed of vibration can be regulated by varying line pressure. Air consumption ranges from 4½ to 8 cfm.

Incorporated into the vibrator is a bronze-alloy cylinder liner which assures positive and permanent piston lubrication. Piston ends are uniformly hardened to resist tendency to flatten. Available from stock in eight sizes, these vibrators are recommended for such applications as removing match plate patterns from sand molds, providing steady flow of powdered or granular materials from hoppers, feeding small parts for assembly, and fatigue testing.

Spo Incorporated, 6430 Grand Division Ave., Cleveland 5, Ohio

(MORE DATA? CIRCLE FYI 39, p. 147)

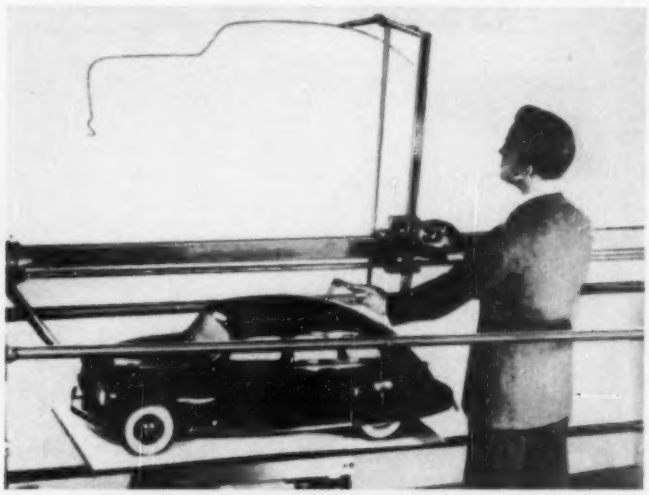


Powdered Metal Used To Make Caster Wheels

Powders composed of tiny particles of metal and graphite are used under pressure to mold caster wheels. After molding to shape the wheels are heat-treated to bond the metal particles together into a strong structural unit. The wheels are then immersed in an oil which fills the very minute pores or voids and serves as a reservoir to give the wheel bearing a self-lubricating quality.

The Bassick Co., Bridgeport 2, Conn.

(MORE DATA? CIRCLE FYI 40, p. 147)



Dupligraph Transfers Contours Of Models, Forming Dies

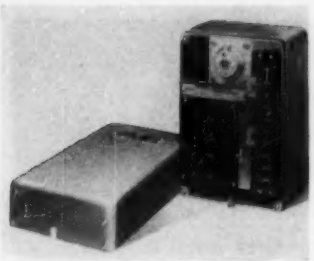
Through the use of an instrument called a Dupligraph, it is possible to reproduce on paper the exact contour of irregular surfaces in a fraction of the time required by the former method of cutting and fitting wood templets.

The instrument is well suited for securing readings in forming dies that cannot be checked with ordinary templets. It may solve the problem of securing a true reading on stampings, die-castings, or jet blades by showing the amount of spring-back or warp that has formed in process.

In the manufacture of products which require the close following of models, the Dupligraph may replace an inspector's time since it gives cross-section lines relative to each other. This is usually done on vellum and checked against the draft or layout. The result is a full contour line as compared with an inspector's spot check.

Inter-Lakes Engineering Co., 4746 Bellevue, Detroit 7, Mich.

(MORE DATA? CIRCLE FYI 41, p. 147)



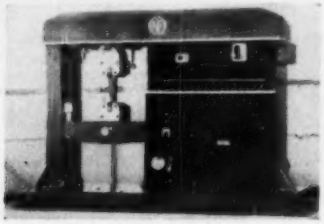
Electronic Timer for Operation, Limit, and Sequence Timing

A compact electronic timer which provides automatic control of operation, limit, and sequence timing for many industrial processes has been announced by General Electric.

According to GE engineers, the timer was designed to fulfill industrial requirements for flexibility of application, accuracy and reliability in operation, low maintenance, and simplicity in servicing. It is available in three time ranges: 0.06 to 1.2 sec., 0.6 to 12 sec., and 6 to 120 sec.

The timer provides a time delay in the operation of its magnetic relay after an external switch, contact, or interlock is initiated.

General Electric, Schenectady 5, N.Y.
(MORE DATA? CIRCLE FYI 42, p. 147)

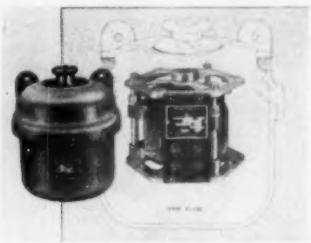


Universal Testing Machine Built in Compact Table Model

Table model testing machine for tension, compression, flexure, shear, and transverse tests is available in two capacities: 30,000 lb and 15,000 lb. Unit is 42 in. high, 64 in. wide and weighs 1200 lb.

Loading is mechanical with crosshead speeds infinitely variable from 0.005 to 6 ipm. The weighing system consists of knife-edge pivot levers connected to calibrated elastic beams made of steel. Material is held by gear-operated wedge grips.

National Forge & Ordnance Co., Irvine, Pa.
(MORE DATA? CIRCLE FYI 44, p. 147)

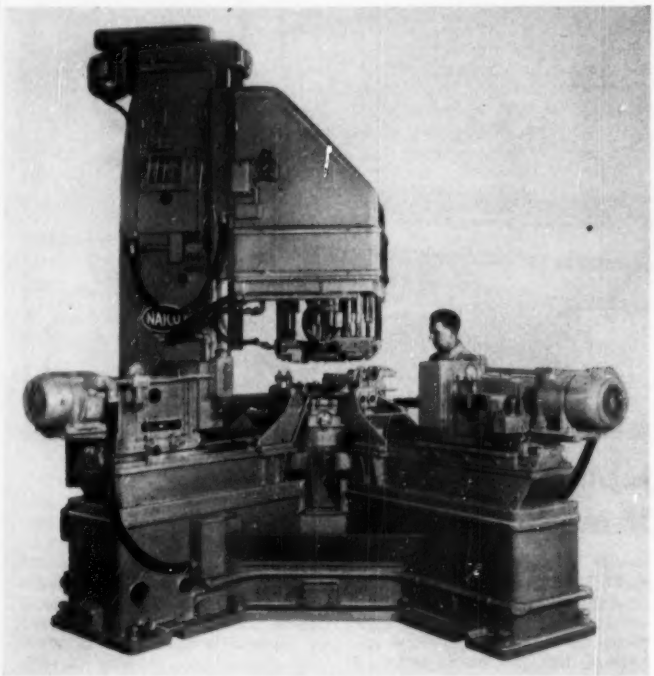


Casing on Transformer Makes it Explosion-Proof

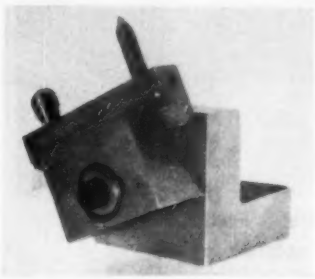
An explosion-proof model has been added to Superior Electric's line of Powerstat variable transformers. The transformer is totally enclosed in a case which will withstand internal gas or vapor explosions. The case will also prevent ignition by internal spark, flash or explosion of the gas surrounding the enclosure.

The units are Underwriters' approved for Class 1, Group D Service. Various types are available in 115- and 230-volt ratings for single-phase operation.

Superior Electric Co., Hannon Ave., Bristol, Conn.
(MORE DATA? CIRCLE FYI 45, p. 147)



FOUR-WAY HORIZONTAL DRILLER machines and assembles 248 refrigerator pistons per hour. Components are a vertical unit and head with standard column-wide ways; left front and rear horizontal units and drill heads, and a section for pressing in tubes, cutting off and inserting brazing wire. Operations include: Drilling, core-drilling, facing, rough and finish reaming, chamfering *National Automatic Tool Co., Richmond, Ind.* (MORE DATA? CIRCLE FYI 43, p. 147)



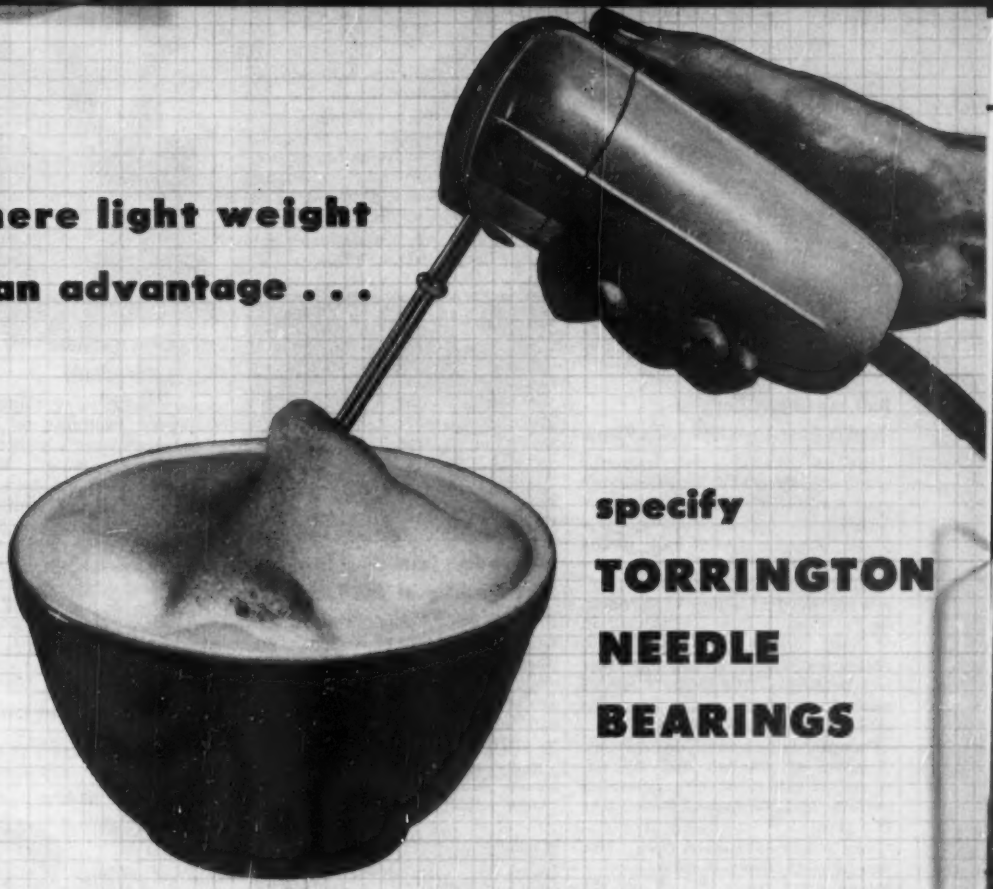
Angle Dresser Works Underneath Grinding Wheel

Sperman Metal Specialties has come out with an angle dresser that works underneath the grinding wheel, thus avoiding removal of the wheel guards. An operating handle keeps the mechanic's hand away from the wheel.

The angle can be set with a protractor from any of the ground sides or base, or it can be set with a sine bar for special work.

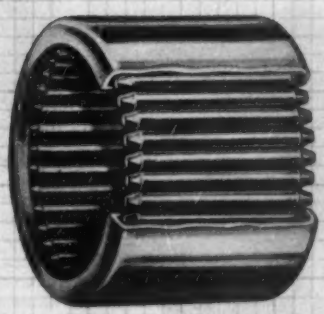
Sperman Metal Specialties, 27 Columbia Place, Brooklyn 2, N.Y.
(MORE DATA? CIRCLE FYI 46, p. 147)

where light weight is an advantage . . .



specify TORRINGTON NEEDLE BEARINGS

By the use of a full complement of small diameter rollers, Torrington Needle Bearings combine maximum capacity with minimum weight. Light in itself, the Needle Bearing also permits reduction in weight and size of related parts, with no sacrifice of strength or efficiency. Our engineers will be glad to help you work out lighter designs with compact Torrington Needle Bearings.



THE TORRINGTON COMPANY
Torrington, Conn. • South Bend 21, Ind.
District Offices and Distributors in Principal Cities of United States and Canada

TORRINGTON *NEEDLE* **BEARINGS**

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • STRAIGHT ROLLER • BALL • NEEDLE ROLLERS

Ball and Groove Keys Used in Gear-Type Hydraulic Pump

Impellers of the Adel hydraulic pump are keyed to driveshaft to prevent thrust loads from being transferred from shaft to impeller or end plates. Key consists of balls placed in three grooves spaced around periphery of shaft and shaftway. Impellers are thus free to float in the pump cavity, despite any lateral motion of shafts. Trapped fluid is utilized to pressure-lubricate shafts, bushings and bearings. This permits use of journal bearings and provides smoother, quieter operation.

Pumps may be assembled for either direction of rotation and are designed for 1000 psi service with rated capacity at 1,800 rpm at from 1.5 to 46.8 gpm.

Adel Precision Products Corp., 10855 Van Owen St., Burbank, Calif.
(MORE DATA? CIRCLE FYI 47, p. 147)

Repulsion-Induction Motor Added to G.E. Tri-Clad Line

A motor combining the high starting torque of the repulsion motor with the constant-speed characteristics of the induction motor has been added to General Electric's Tri-Clad line. Designated as type SCR, the motor is available in 5-, 7½-, and 10-hp ratings, all 1800 rpm. The 5-hp unit operates on 115 or 230 volts, while the other two use 230 volts.

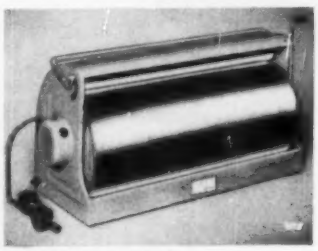
For proper alignment between stator and rotor, the ball bearings are mounted directly in the end shields. Cooling is provided by a single large-diameter cast-aluminum fan. The cast-iron frame has a damping effect on noise and vibration, and covers are readily removed to facilitate inspection and maintenance.

General Electric, Schenectady 5, N.Y.
(MORE DATA? CIRCLE FYI 48, p. 147)

Nesting Caps Permit High Stacking of Coil-Racks

Portable coil-racks have nesting caps welded on the tops or bottoms of the upright members to permit safe stacking to any height. The caps are self-centering so that the racks can be readily placed in position by a lift truck.

Equipment Manufacturing, Inc., 21580 Hoover Road, Detroit 5, Mich.
(MORE DATA? CIRCLE FYI 49, p. 147)

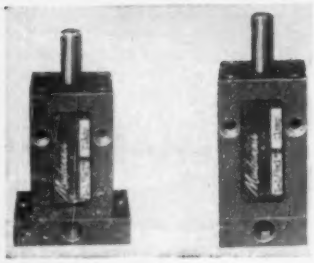


Portable Print Dryer Has Stainless-Steel Drum

Portable dryer has a 23x28-in. mirror-finish stainless-steel drum which, the manufacturer claims, far outwears plated surfaces. Called the Rotomaster, it will turn out glossy photographic prints as well as matte prints and blueprints.

A two-heat element maintains a constant temperature according to setting. Built-in squeegee simplifies application of prints to the drying surface. A full load is dried in 4 to 8 min, depending on weight of material and other variables. It draws 300 watts on 115 volts ac.

Lott Mfg. Co., 45 Parker Ave., Jamestown, N.Y.
(MORE DATA? CIRCLE FYI 50, p. 147)



Air-Clamp Cylinder Has Square Body

Square design on air-clamp cylinders facilitates mounting so that units may be put closer together than with conventional clamps. Made from aluminum extruded stock, body and end caps have high tensile strength. Standard Allen screws, used to secure end caps, permit locating caps with inlet port convenient to piping connections.

Long guide bushing is held to a close tolerance with the piston rod. This is claimed to insure long service life. Standard "O" ring is used for the piston seal.

Modernair Corp., 4222 Hollis St., Oakland 8, Calif.
(MORE DATA? CIRCLE FYI 51, p. 147)

Vise Provides Four Planes of Adjustment

A vise made up of four separate parts, each of which can be rotated, provides four separate, distinct planes of adjustment, allowing a tool to be held at any conceivable angle. Called the Univise, it fits any surface or tool grinder. Because the keys on its base can be detached, the Univise can also be used on a drillpress or other machine without table slots. The vise is 5 13/16 in. high, 6 in. wide, and 7¼ in. long. Its jaws take up to 1½ in. tools.

Delta Power Tool Div., Rockwell Mfg. Co., Milwaukee 1, Wis.
(MORE DATA? CIRCLE FYI 52, p. 147)

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FYI—these initials symbolize information that's important. We use them, too, to head our expanded reader service. Here are two postcards which will bring you new literature, bulletins on new equipment, materials or parts, further information from any advertiser, or advice from editors—for a 3-cent stamp.

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NEW BULLETINS

MACHINERY AND ATTACHMENTS

1 AUTOMATIC LATHES—*Pratt & Whitney, West Hartford 1, Conn.* 8-page bulletin features the Model C 1¼x18-in. full-automatic lathe. Construction details, specifications, and work the lathe will handle are covered.

2 PRESSES—*Lake Erie Engineering Corp., Buffalo, N.Y.* 12-page booklet covers a line of side-housing presses from a capacity of 150 to 1,000 tons. Illustrations show the double- and triple-action presses in action. Features such as press structure, hydraulic system, cushions, electrical circuits and controls are covered.

3 AUTOMATICS—*Cleveland Automatic Machine Co., Cincinnati 12, Ohio.* 8-page bulletin describes 3¼- and 5¼-in. single-spindle automatic screw machines. Separate, instantly adjustable feeds can be pre-selected with use of the electric-feed drive. Construction features and specifications are included.

4 DRILL-PRESS VISE—*Universal Vise and Tool Co., Parma, Mich.* 4-page bulletin shows how a drill-press workholder can be used with any drill press by the selection of any of seven adapters. Specifications and prices are included.

5 DISK GRINDER—*Mattison Machine Works, Rockford, Ill.* 4-page bulletin covers a vertical-spindle disk grinder and its application, such as wet and dry grinding. Specifications and factory applications are covered.

6 MILLING—*Nichols-Morris Corp., New York 7, N. Y.* 4-page bulletin illustrates and describes a twin-headed milling machine. Construction details covered are spindles, columns, knees, saddles, table drive, control system, and lubrication.

TOOLS AND ACCESSORIES

7 COLLET CHUCKS—*Universal Engineering Co., Frankenmuth, Mich.* 23-page illustrated catalog gives specifications and prices on a large variety of chucks. Among those covered are coolant-fed, boring and adjustable-collet chucks.

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FREE details about new machines & tools
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FREE shop calculators and data sheets
FREE information from advertisers
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8 VISES—*Wilton Tool Mfg. Co., Chicago, 14, Ill.* 32-page catalog describes a line of vises, C-clamps, work positioners, and piston setters. Prices are listed.

9 DRILL HEADS—*Thriftmaster Products Corp., Lancaster, Pa.* 20-page illustrated brochure contains information on the design, detail and construction of 50 multi-spindle drill heads.

10 GRINDING WHEELS—*Simonds Abrasive Co., Philadelphia 37, Pa.* 4-page catalog ESA-191 describes grinding wheels for plain cylindrical grinding, grain and grade recommendations for each class of material, and data on speeds and feeds.

11 HONES—*Sunnen Products Co., St. Louis, Mo.* 4-page illustrated booklet describes an external hone for pins, spindles, plungers, shafts, and other parts, with diameters from 0.120 to 2.75 in. Tells how to remove "rainbow warpage" resulting from heat-treating, "cloverleaf" pattern left by centerless grinding, and other defects.

HEAT-TREATING AND WELDING

12 WELDING ELECTRODES—*Welding Equipment & Supply Co., Detroit 7, Mich.* 56-page catalog covers the Eureka line of tool- and die-welding electrodes. Much technical information on metallic-arc tool-steel welding is included.

13 INDUCTION HEATERS—*Electric-Arc Inc., Newark 8, N. J.* 2-page bulletin illustrates and describes induction heaters and control instruments for pre-heating and stress relieving.

14 WELDING EQUIPMENT—*Lincoln Electric Co., Cleveland 1, Ohio.* 8-page catalog describes welding cabin, protective shields, electrode holders, ground clamps, cable lugs, arc torches, and other items.

PLANT SERVICE EQUIPMENT

15 OIL BURNERS—*Hauck Mfg. Co., Brooklyn 15, N. Y.* 8-page catalog 456 describes a Venturi high-pressure steam or air-atomizing oil burner for industrial firing in smelting, metal heat-treating, glass, ceramic, chemical, and rock product plants.

16 PRESSURE JOINTS—*Phillips Rotary Joint & Valve Co. Inc., Hoboken, N. J.* 8-page booklet gives construction details of flexible rotary pressure joints and installation suggestions. Specifications of the different models are included.

17 WATER CLARIFIER—*Cochrane Corp., Philadelphia 32, Pa.* 16-page booklet explains how cold water is clarified and softened by sludge-contact reactors. Illustrations and diagrams show typical applications, and how the reactors operate.

18 DC MOTORS—*Reliance Electric and Engineering Co., Cleveland 10, Ohio.* 12-page bulletin C-2001 gives design, construction, selection, and ordering information on dc motors from ¼ to 1000 hp.

19 FIRE-FIGHTING CHEMICAL—*Aquadyne Corp., New York 17, N. Y.* 12-page bulletin shows how Pyrodyne capsules convert ordinary water into a liquid of much lower surface tension; speeding wetting and cooling.

20 SAFETY EQUIPMENT—*Mine Safety Appliances Co., Pittsburgh 8, Pa.* 4-page bulletin describes personal-protection equipment for shot and sand blasters. Includes masks, helmets, and respirators.

21 CENTRIFUGAL PUMPS—*Eastern Industries, Inc., New Haven, Conn.* 12-page bulletin 100 describes centrifugal pumps for a wide range of industrial applications. Specifications and pumping-capacity graphs accompany illustrations of the models.

PARTS AND MATERIALS

22 STEEL COLOR CODE—*United States Steel Supply Co., Chicago 4, Ill.* 1-page chart shows a color code for positive identification of the company's steel. The chart covers alloys, stainless, carbon, and plate and structural steel.

23 VALVES—*Catawissa Valve & Fittings Co., Catawissa, Pa.* 20-page catalog 11, illustrates and describes a line of unions and valves. Specifications and test data are included.

24 SELF-TAPPING SCREWS—*Parker-Kalon Corp., New York 14, N. Y.* 48-page bulletin 430 is systematically arranged to provide quick reference to any type of self-tapping screw desired. It gives application information, hole sizes, stock sizes, head styles, and dimensions.

25 BLACKENING—*Enthone Inc., New Haven, Conn.* 8-page bulletin describes blackening processes for copper and copper alloys, irons and steels, and zinc and zinc alloys. The characteristics of the coatings and procedure for using them are included.

26 ALUMINUM EXTRUSIONS—*Aluminum Co. of America, Pittsburgh 19, Pa.* 12-page booklet on aluminum extruded shapes shows design and cost considerations, examples of where and how they can be used, terminology and specifications.

27 SEAMLESS TUBING—*Tube Reducing Corp., Wallington, N. J.* 12-page brochure shows how the Rockrite process cold forges metal into seamless tubing. Description of the sizes, shapes, and form available is included.

MISCELLANEOUS

28 CURTAIN WALLS—*Allegheny Ludlum Steel Corp., Pittsburgh 22, Pa.* 24-page booklet is a progress report on proposed methods of curtain wall construction made with prefabricated sections of stainless steel sheathing and insulation.

29 MICROCASTING—*Microcast Div., Austenal Laboratories, Inc., Chicago 37, Ill.* 16-page booklet includes applications of precision castings, specifications, and step by step explanation of the microcast process.

30 ELECTROSTATIC PRECIPITATION—*General Electric, Schenectady, N. Y.* 16-page, two-color bulletin GEA-5212 explains how electrostatic precipitation works, gives case history of seven typical installations, and describes various electric equipment applicable to each method.

A Typical Machine Shop Reports:

33% BETTER PRODUCTION

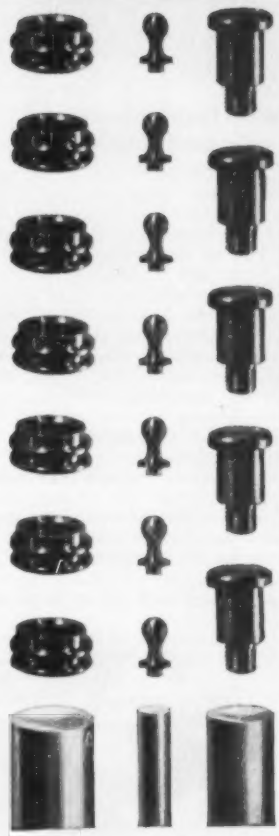
... Longer Tool Life

... Better Finish

WITH J&L FREE-CUTTING "E" STEEL

... THE NEW FREE-CUTTING BESSEMER SCREW STOCK

J&L STEEL



PARTS SHOWN ACTUAL SIZE

Hundreds of profit conscious machine shops throughout the metal-working industry have switched to J&L "E" Steel to ensure dollar savings through longer tool life and increased production.

Here's a report from a typical independent shop which produced the parts shown actual size at right:

> "J&L 'E' Steel machines very well . . . the finish obtained has been excellent . . . our tool life has been increased . . . we have been able to realize 33% better production. We are interested in changing all our specifications to your new 'E' Steel."

These are reasons why J&L "E" Steel has been so enthusiastically accepted throughout the industry. But there are others—four years of exhaustive field testing in over 100 applications proved J&L "E" Steel's superiority. Now since "E" Steel has been on the market, 80% of the new users report:

- ★ Better Machine Finish
- ★ Longer Tool Life
- ★ Higher Speeds
- ★ Machinability Ratings up to 170
- ★ Better Response to Forming and Cold Work

J&L "E" Steel is made in three grades: *E-15*, *E-23*, and *E-33*, each within the composition limits of the standard bessemer screw steels and with similar tensile properties.

Investigate the production economies you can gain with J&L "E" Steel. Write today for your free copy of the booklet "Faster Machining... Smoother Finish ... Longer Tool Life." It will give you additional information on properties, grades and their equivalents, and applications.

"E" Steel (U.S. Pat. No. 2,484,231) is easily identified by the distinctive blue color on the end of every bar.

Jones & Laughlin Steel Corp.
402 Jones & Laughlin Building
Pittsburgh 30, Pennsylvania

Please send me your booklet, "Faster Machining . . . Smoother Finish . . . Longer Tool Life," describing J&L "E" Steel.

NAME_____

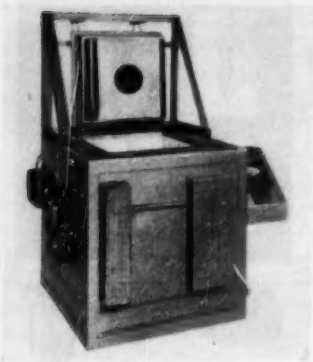
ADDRESS_____

COMPANY_____

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L *manufactures a full line of carbon steel products, as well as certain products in* OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS



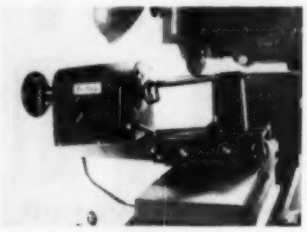
Upright Electric Furnace Handles Small-Batch Heating

Vertical furnace is for basket heating and steel hardening. One model heats to 1250 F with an inside fan for equalizing temperatures. A second model has a maximum temperature of 2000 F without recirculation. Chamber size is 21x21x30 in.

Coiled Kanthal heating elements are mounted on the sides in refractory plates. A transite-board top and an asbestos-seal recirculating door aid the insulation in holding heat. Temperature is controlled by a No. 292 Weelco Capacitrol. Power relays, a fused switch box, and all interconnections are factory-installed.

The furnace has 12-gage body plates and all exposed metal parts inside are stainless steel. Over-all dimensions are 60x48x72 in.

K. H. Huppert Co., Chicago, Ill.
(MORE DATA? CIRCLE FYI 55, p. 147)



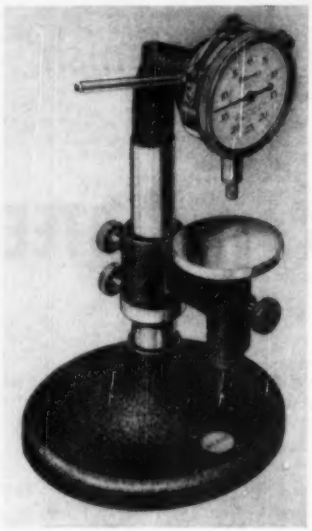
Surface Grinder Converted For Cylindrical Work

Spindle speeds of 200, 400, and 700 rpm are obtained from a built-in motor through step pulleys in a cylindrical grinder and indexing attachment that will handle work up to 6½-in. swing and 7 ⅛ in. between centers. Work to be ground can be chucked or can be held in collets up to ½-in. diameter.

The attachment is equipped with a two-way sine-bar tilt arrangement which allows taper work up to 45°. A 24-division index plate is provided, and plates with a larger number of divisions are available. The spindle is mounted in roller bearings, and the speed reducer has a hardened worm and fiber worm gear. An adjustable indicator bar is standard equipment.

Faceplates, male and female centers, a diamond holder, a steadyrest for small work, larger collets, and a rapid-action lever collet closer are available as extra attachments.

The DoAll Co., Des Plaines, Ill.
(MORE DATA? CIRCLE FYI 56, p. 147)



Dial Bench Gage Has Table Adjustment

Small parts are inspected rapidly with a No. 652 universal dial bench gage. Indicator readings are accurate to five tenths. The gage is suitable for use as a comparator or a thickness gage.

A lever is pressed down to lift the spindle and release it to contact the work. Left-hand operation allows a free right hand. Zero adjustments are made and then locked with a bezel clamp. The standard model indicates reading to 0.125 in.

A vertically adjustable table is ground and lapped to provide a smooth and accurate surface. This can be shifted by means of a fine adjusting screw. Spring-contact pressure is pre-determined, which reduces the necessity for operator skill.

The L. S. Starrett Co., Athol, Mass.
(MORE DATA? CIRCLE FYI 57, p. 147)

Portable Gas Torch Has Replaceable Cartridge

A portable, propane-operated, gas hand torch is available with a replaceable cartridge. When empty, the cylinder is quickly unscrewed and replaced with a filled one weighing 2½ lb.

The torch requires no pumping or preheating and is equipped with interchangeable burners, designed to suit special needs. The pencil-flame burner produces a fine, hot flame that is instantly adjustable from pinpoint size up to a 2 in. length inner cone. The utility burner gives a brush-type flame adjustable from 2 in. to 4 in. The calculated flame temperature for both burners is 3660 F.

Otto Bernz Co., Inc., 280 Lyell Ave., Rochester 6, N. Y.
(MORE DATA? CIRCLE FYI 58, p. 147)

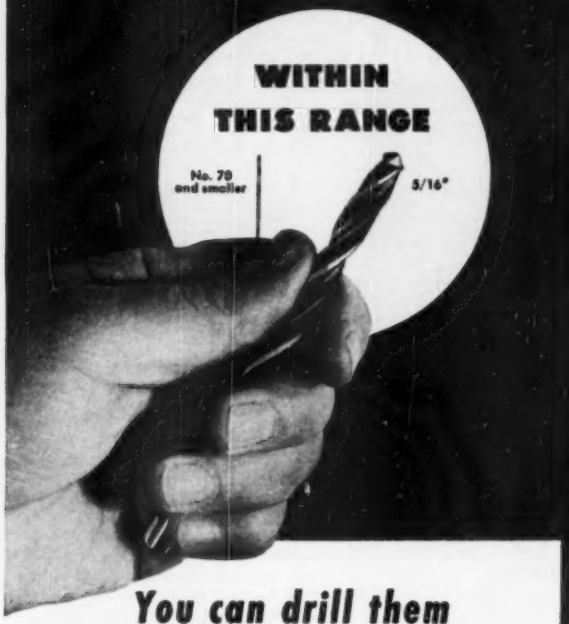
Additional Proto Puller Models Pull Bearings in Tight Places

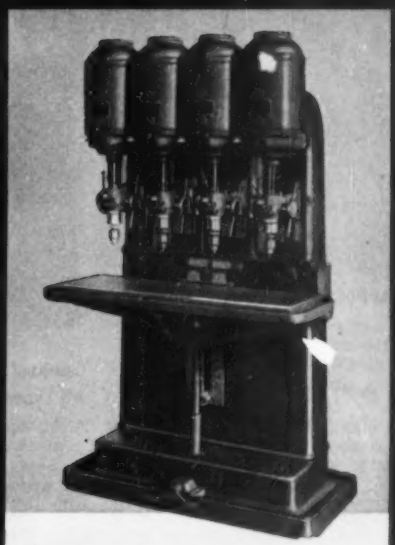
Additions to the line of Proto puller items include a bearing separator-puller plate, 14 step-plate adapters, two jaws, and two screw tips. The separator-puller plate No. 4032 has flat surfaces and knife-like edges for insertion behind bearings or gears where space is limited.

The step-plate adapters fit into the ends of hollow shafts or housings and provide a base for a puller screw.

Plomb Tool Co., Los Angeles, Calif.
(MORE DATA? CIRCLE FYI 59, p. 147)

If you drill Precision Holes





- Bench or Floor Types
- One to Six Spindles
- Speeds up to 10,800 RPM
- 12 or 20 Inch Swing
- Hand or Hydraulic Feed
- Tapping by Friction Tapping Attachment

You can drill them Better, Faster and at LESS COST with

LELAND-GIFFORD

NO. 1 LMS MOTOR SPINDLE

Drilling Machines

Precision holes cost less when you use the right machine for the job. For small holes—from the smallest up to 5/16" — the *right* machine is the Leland-Gifford No. 1 LMS Motor Spindle Drilling Machine. Available adapted precisely to your needs. Super sensitive yet ruggedly built to maintain accuracy and to keep on producing precision work with ease and accuracy year after year. Write for complete information.

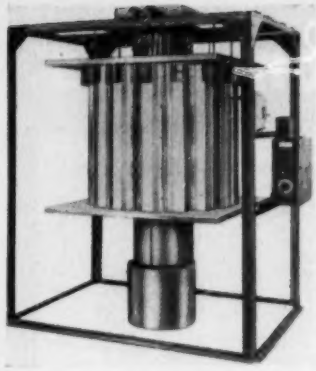
PRODUCTION MEN
Get This Handy Slide Rule

A valuable aid in figuring costs and setting production schedules. Quickly gives time required to drill holes of any size and depth in any material. It's free. Write the nearest office.

LELAND-GIFFORD
Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 6, 605 W. Washington Blvd.; DETROIT 26, 1533 Dime Bank Bldg.; CLEVELAND 1, P. O. Box 5647; NEWARK 2, Industrial Office Bldg.; ROCHESTER 4, Commerce Bldg.; LOS ANGELES 14, 726 So. Spring St.



Oven With Vibratory Conveyor Heats Plastic by Infra Red

The Spira-Veyor heats plastic powder for injection and extrusion molding by infra-red heat. The powder travels up the spiral ramp by vibratory action of the spiral.

Temperature can be adjusted at any setting from room temperature to 400 F. The timing instrument can be set to move the material intermittently. For example, to operate 10 sec and to hold for 30 sec. Powder is loaded at floor level and discharged at the top into storage drums or hoppers of plastic molding machines.

The Miskella Infra-Red Co., E. 73rd and Grand Ave., Cleveland 4, Ohio

(MORE DATA? CIRCLE FYI 60, p. 147)

Compact Time Switch For All Types of Timing Operations

Electronic time switch provides a compact unit capable of meeting extreme flexibility in all types of timing operations. It employs only one tube and operates from the discharge of a timing capacitor in the grid circuit. Four basic types of timing are provided: Interval, delayed action, automatic repeat, and programming.

Timing-period control is accomplished by means of a selector switch with four ranges: 1 sec, 10 sec, 1 min, and 4 min. A variable resistor provides for intermediate time interval.

Henry G. Dietz Co., Box 248, Forest Hills, N. Y.

(MORE DATA? CIRCLE FYI 62, p. 147)

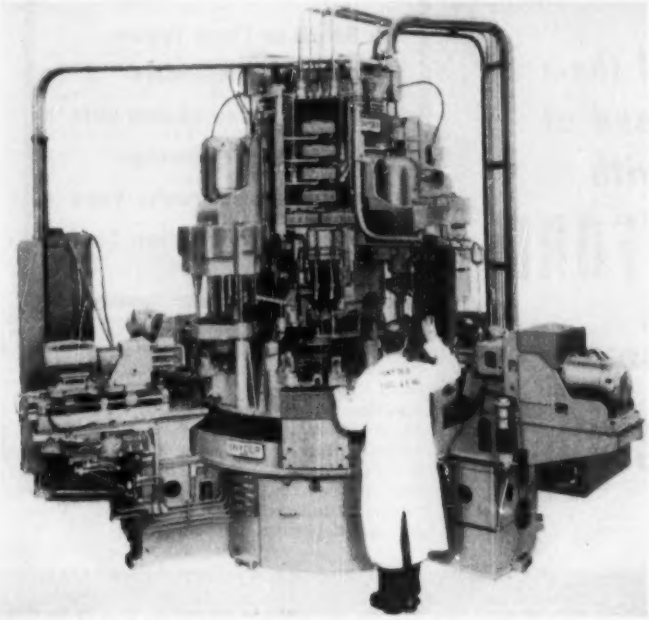
Portable Heating Unit Adaptable to Many Uses

A 1-in. length of steel rod can be heated to 1500 F in approximately 3 sec by this high-frequency induction heater. It can be used to braze carbide tips to cutting tools up to 1½-in. square. Some of its other applications are for hardening, annealing, normalizing and soldering ferrous and non-ferrous metals.

Unit is used with 110 volts, 50- or 60-cycle line current. Heating cycles can be preset for desired temperatures with automatic timer and operated by pushbutton or foot switch.

Lepel High Frequency Laboratories, Inc., New York, N. Y.

(MORE DATA? CIRCLE FYI 63, p. 147)



AUTOMATIC CYCLE MACHINE with six stations processes a cast-iron converter housing for automatic transmissions in 31½ seconds. It drills, chamfers, reams, counterbores, or taps, a total of 51 holes ranging in size from 4 in. diameter to F(0.257 in.) at 100 % efficiency. Tool speeds in fpm are, for drilling and chamfering 80, reaming 45, counterboring 250, and tapping 20. Feed rate is 6 ipm. Twelve 1800-rpm motors are used, ranging from 1 to 7½ hp.—*Snyder Tool & Engineering Co., 3400 E. Lafayette Ave., Detroit 7, Mich.*

(MORE DATA? CIRCLE FYI 61, p. 147)

Calculator Gives Thread Data For Unified American Standards

Slide calculator provides a rapid and convenient means of obtaining standard thread plug and ring-gage dimensions under the new Unified and American screw thread standards. A single setting determines major and pitch diameters for go and not go thread plug gages for classes 1B, 2B, and 3B, and minor and pitch diameters for go and not go thread ring gages for classes 1A, 2A, and 3A. The calculator is in the form of a card, plug-gage dimensions on one side, ring-gage dimensions on the other. The price is $1.

The Taft-Peirce Mfg. Co., Woonsocket, R. I.

(MORE DATA? CIRCLE FYI 64, p. 147)

NOW... AMERICAN SCREW CO.
Steps Up National Distribution

New plant at Willimantic, Conn. . . . one of the most modern operations in the screw industry.

...as production steps up in NEW WILLIMANTIC PLANT

American's pipelines are being pumped full of ample supplies of all types of Phillips and slotted fasteners. Industrial supply distributors and hardware jobbers from coast to coast are set to serve you *now*.

For American's new high-production plant in Willimantic is now geared up to meet all demands promptly and efficiently. And this production is further augmented by the American plant at Norristown, Pa., while distribution is kept on a "delivery now" basis by large warehouse stocks in Norristown and Chicago.

So today, if you want *action* on orders for Phillips and slotted fasteners . . . just mark those orders "AMERICAN"!

Norristown, Pa., plant, now a full-scale American production unit manufacturing a complete line.

Chicago Warehouse in North Pier Terminal, 589 E. Illinois St., Chicago, Ill.

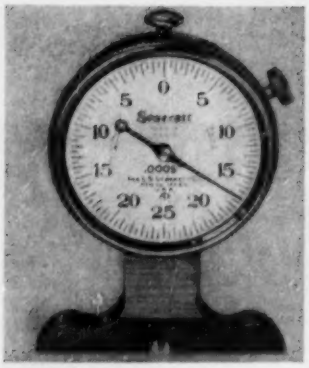
AMERICAN SCREW COMPANY
Plants at:
WILLIMANTIC, CONN. and NORRISTOWN, PA.
Warehouses at:
589 E. ILLINOIS ST. CHICAGO 11
502 STEPHENSON BLDG. DETROIT 2

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

Phillips

AMERICAN SCREWS

Slotted



Knife-Edge Dial Gage Checks Tiny Slots

Small holes, recesses, and slots which are too small for ordinary depth gages can be measured with a new dial gage that is equipped with a knife-edge base 2½ in. long and a needle-point rod. The gage is adapted to measure threads or the result of any cutting, etching, or engraving process.

Both the base and point are hardened, ground, and lapped; and the base is notched out to permit unobstructed vision of the point. Positive finger pressure on the push-button at the top of the gage is required to depress the point. Depths to 0.125 in. will register directly in thousandths.

The L. S. Starrett Co., Athol, Mass.
(MORE DATA? CIRCLE FYI 65, p. 147)

Magnetic Cleaner Removes Ferrous Scrap

Permanent magnet clean-up unit, designed for use on any hard surface area where nails, bolts, and scattered ferrous materials must be removed from floors or alley-ways. Lever-operated clean off drops load with a simple flip of the handle, removing material from the magnet.

Clean-up comes in two models to fit varying needs, one 24 in., and the other 36 in. wide. Both units are suitable for use on smooth or reasonably uneven surfaces.

F. W. Shrader Co., 5788 Washington Blvd., Culver City, Calif.
(MORE DATA? CIRCLE FYI 66, p. 147)

Dynamic Micrometer Measures Metal Body's Vibration

Electro dynamic micrometer consists of a conventional mechanical micrometer head with sensing unit, and an electronic cabinet that is used with a cathode-ray oscillograph. The instrument will accurately measure amplitude of dynamic movement at any speed to distances as small as 0.0001 inch without physical contact with the body.

The principle employed is the change in reactance of a sensing coil when its high-frequency field encounters a vibrating metal body. The change in reactance or impedance of the coil provides a small amount of voltage drop across the coil and, therefore, a low degree of modulation percentage of the carrier voltage. By means of electronic circuits, these small voltage changes are amplified many times, providing a sensitivity to the minute changes in distances equal to 1% of total displacement.

Electro Products Laboratories, Inc., 4501 North Ravenswood Ave., Chicago 40, Ill.
(MORE DATA? CIRCLE FYI 67, p. 147)

Tough Plastic Developed for Gears and Other Applications

Enrup, a plastic developed by U. S. Rubber Co. is claimed to fulfill a need for a high-strength material which is resistant to abrasion and chemicals and, at the same time, can be produced in varying degrees of flexibility ranging between elastic soft rubber and brittle hard rubber.

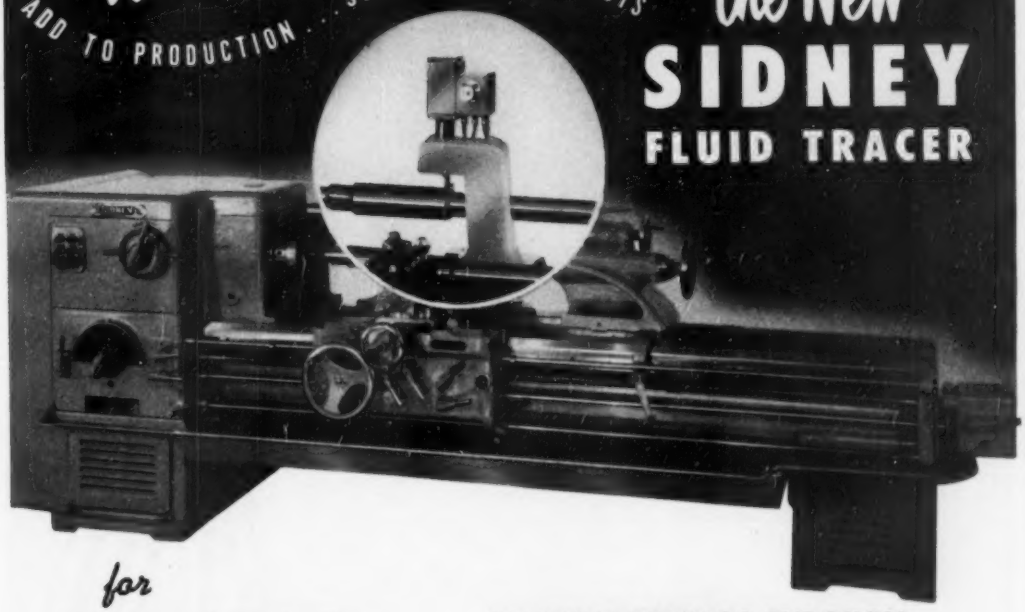
A principal application is the manufacture of high-strength low-cost gears to replace metal gears in such applications as heavy-duty lathes, household appliances, plating barrels, automotive timing devices and dynamometers. Gears can be molded in one piece to a close tolerance which eliminates the need for more elaborate finishing operations.

The plastic is particularly suited for washing-machine parts where it is claimed to have a resistance to the newer synthetic detergents. Among the other possible applications for the plastic are fuel-pump parts, battery cases, dies and jigs, valve seats, plating barrels, filter press plates, tote boxes, bearings, electrical insulators, and various automotive parts. It is available in the form of sheets, rods, tubes, gear blanks, and as molded parts.

United States Rubber Co., 1230 Ave. of the Americas, New York 20, N. Y.
(MORE DATA? CIRCLE FYI 68, p. 147)

NOW... the New SIDNEY FLUID TRACER

ADD TO PRODUCTION . . . SUBTRACT FROM COSTS



for

- **increased production**
- **greater versatility**
- **wider range of work**
- **LOWER COSTS**

Here's an all-hydraulic controlled tracer with a DUAL PURPOSE . . . for tracing from round or flat template and regular lathe work with unlimited range for both. Note how simple: just position one lever on clutch and brake unit to engage or disengage the tracer . . . that's all. No loss of time, no extra space, no parts to bother with, no extra expense for a single-purpose tool.

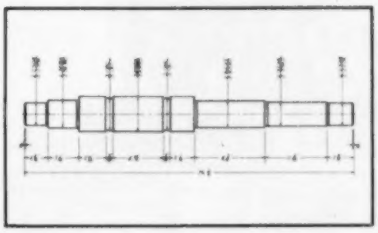
ABSOLUTELY SAME PRECISION ACCURACY AS WITH ALL SIDNEY PRODUCTS. Changes in contour of the master piece are transmitted through the ultra-sensitive tracer valve as magically as if by an "electric eye" . . . even sharp shoulders are faced to amazingly close limits.

ADD the Sidney Fluid Tracer to any Sidney Model 32 Lathe. You'll enjoy the savings and efficiency of

THE FINEST TURNING TOOL EVER PRODUCED

Please write for detailed literature or contact your nearest Sidney representative.

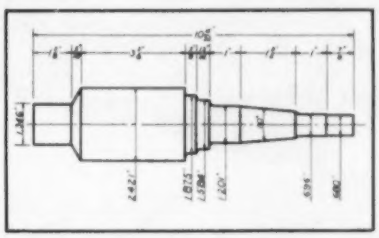
AMAZING SAVINGS THROUGH SIDNEY TURNING TIME



Normal Turning Time
4 hrs. 33 min.

SIDNEY TURNING TIME
38 min.

YOU SAVE
3 hrs. 55 min.



Normal Turning Time
25 min.

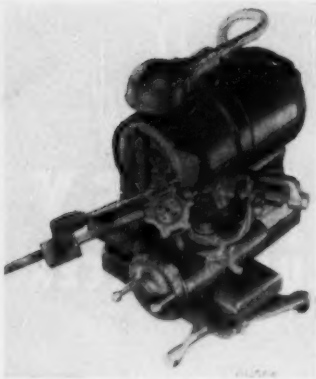
SIDNEY TURNING TIME
2 min. 31 sec.

YOU SAVE
22 min. 29 sec.

The SIDNEY MACHINE TOOL Company

Builders of Precision Machinery

SIDNEY — ESTABLISHED 1904 — OHIO

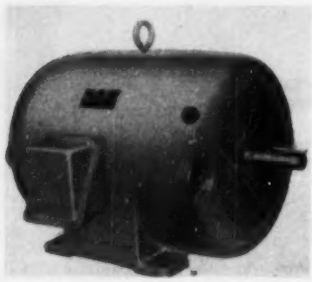


Sellers Drill Grinder Designed With Quick-Adjusting Tail Center

Increased accuracy, reduced wear and further ease of operation is claimed for the Sellers No. 1G drill grinder. Changes include a quick-adjusting tail center, ball-bearing slide, and ball-bearing swing frame. It provides theoretically correct drill lips ground with the same inclination to the drill's axis, of equal length and with proper clearance at both center and periphery.

A bench-type grinder, it produces drill points on one or any quantity of drills in sizes as small as 0.028 and up to ½ in. diameter. Additional capacity is obtained with a special attachment which permits grinding drills from ½ in. to 1 in. diameter.

William Sellers Div., Consolidated Machine Tool Corp., Rochester 10, N. Y.
(MORE DATA? CIRCLE FYI 69, p. 147)



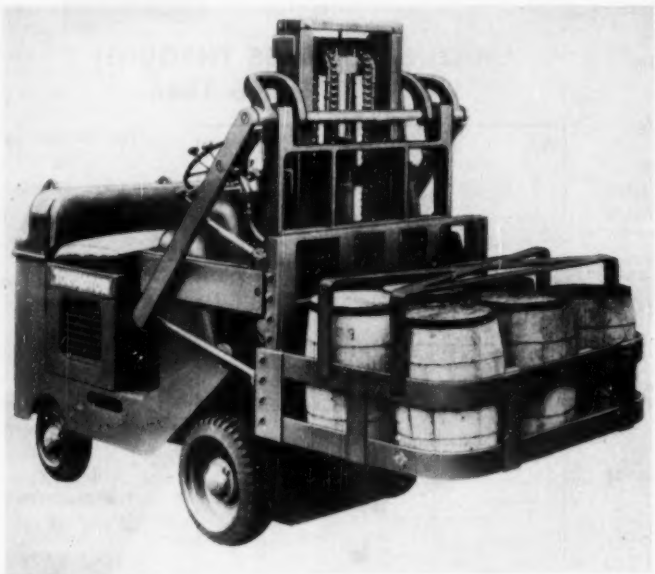
Cast-Iron Frame Motors Afford Corrosion Protection

Totally enclosed cast-iron frame motors especially suitable for applications in plants where corrosion is a problem, either because of the nature of the materials processed, or because the motors must be installed outdoors have been developed by Wagner Electric.

Construction details include: Rotor squirrel cage of aluminum, cast under heavy pressure. Each rotor is dynamically balanced to insure freedom from vibration.

After the windings are in place, the stator is baked to remove all moisture and, while still hot, immersed in a heavy insulating varnish. When the heated stator core is immersed in the much cooler varnish a vacuum is created which produces complete impregnation of the windings. Motors are available in ratings from 5 to 250 hp. in both standard and explosion-proof designs.

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo.
(MORE DATA? CIRCLE FYI 71, p. 147)



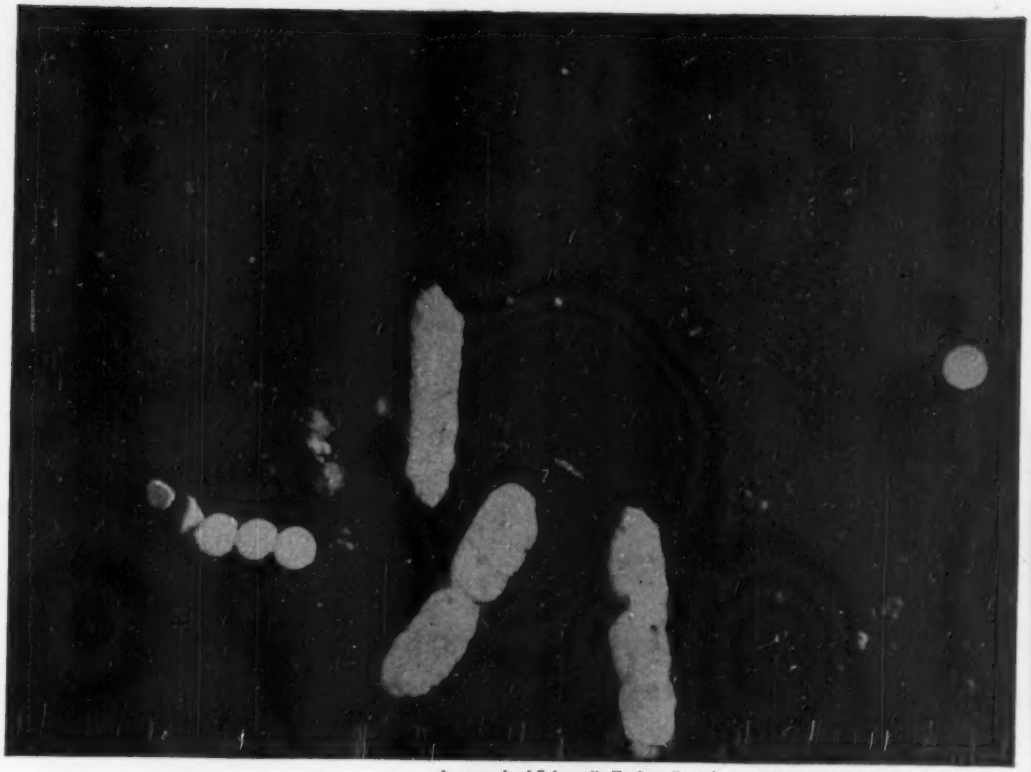
HYDRAULIC TOWMOTOR keg-handling device picks up, transports, stacks and unloads six, 200-lb. kegs of material in a single maneuver. Guide frame mounted on unloader accessory with 10-in. stroke is lowered over the kegs. As the unloader is retracted, the guide frame pulls the kegs against three rubber-covered shoes which project from the face of the carriage. The need for a carrying plate has been eliminated, therefore the truck can be used with standard forks.
—Towmotor Corp., 1226 E. 152nd St., Cleveland, Ohio
(MORE DATA? CIRCLE FYI 70, p. 147)

Magnetism Increased In Bit Holders, Drivers

Ten times the "pull" of ordinary magnetic tools is claimed by Magna Tool for its new bit holders and hex drivers. Permanent Alnico magnet in the bit holder shank permits the use of interchangeable, low cost screwdriver bits. Starting and driving screws in awkward or hard-to-reach places is a one-hand operation, leaving the other hand free to hold parts being assembled.

Magna hex drivers are available in all standard sizes from ¼ to ½ in. Bit holders are available for all makes of power drivers in ¼ and 7/16 hex shanks, tang drives, and threaded shanks.

Magna Tool Corp., Buffalo 3, N. Y.
(MORE DATA? CIRCLE FYI 72, p. 147)



An example of Salmonella Typhosa Bacteria, magnified 30,000X by Electron Microscope.

Are Bacteria Biting Into Your Profits?

When bacteria and mold attack lubricants and coolants, causing them to go sour, they result in expensive production delays and costly material wastes.

Now you can prevent these microorganisms from producing *machine down time* and wasted materials. Dowicides, Dow's industrial germicides and fungicides, incorporated in cutting, grinding, rolling and hydraulic soluble oil emulsions, will prevent the growth of bacteria and mold, thus increasing the service life of the oils. Dowicides are available in both oil and water soluble types.

Keep bacteria from biting into your profits. Learn more about Dowicides today. Complete laboratory facilities are maintained by Dow to help solve your problems. Contact your nearest sales office or write direct.

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

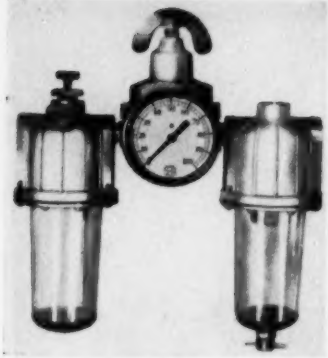
New York • Boston • Philadelphia • Washington • Atlanta
Cleveland • Detroit • Chicago • St. Louis • Houston
San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Canada

use the

Dowicides

Industrial Germicides and Fungicides

DOW CHEMICALS
INDISPENSABLE TO INDUSTRY AND AGRICULTURE



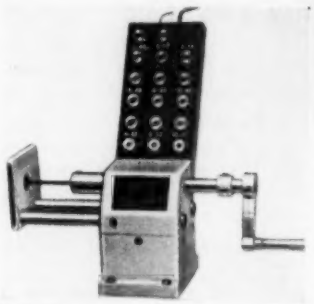
Compressed Air Unit Purifies and Lubricates

Complete compressed air control unit provides constant, clean, lubricated air for working surfaces. Purification is accomplished by a series of positive impinging baffle plates, so arranged as to give maximum surface contact on each plate with the medium to be purified. Entrained foreign substances are drained into a plastic bowl which permits instant checking of entrainment level.

The lubricator produces a suspended oil vapor by carburetor control eliminating any oil slugs or drops. Its action automatically adjusts oil volume to variations in pressures.

Airlube, Inc., 3422 West North Ave., Chicago 47, Ill.

(MORE DATA? CIRCLE FYI 73, p. 147)



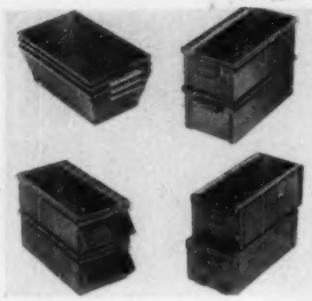
Hand Tapper With Guide Can Be Fixed or Portable

A hand tapper for screw threads from 0-80 to 10-32 is known as the "Tapit." It can be operated bolted to a bench, or the upper half can be held in a vise or taken to the work.

Twin guide bars with a platen on the end hold the work in alignment with the tap. The price is $25 without taps and angle plate.

Photo Research Corp., Burbank, Calif.

(MORE DATA? CIRCLE FYI 74, p. 147)



Steel Shop Boxes Made More Durable

Union Metals' line of shop boxes incorporate innovations such as full-length bottom runners, one-piece bottom and end construction, double-reinforced corners, elimination of end offsets to simplify material removal, and other features calculated to prolong box life and contribute to handling efficiency.

The boxes are being built in a wide range of standard sizes, types and combinations suitable for most small part handling requirements, and the company is also offering development service to produce special shop boxes to meet any out-of-the-ordinary handling needs.

Union Metal Mfg. Co., Canton 5, Ohio

(MORE DATA? CIRCLE FYI 75, p. 147)

Wash Solution Cuts Cleaning Time

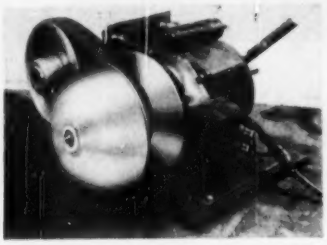
Acid-cleaning with Turco 1620 process does three things at once: removes soil and dirt, provides a good paint bond, and inhibits rust. This combination often eliminates precleaning and final chromic-acid rinse.

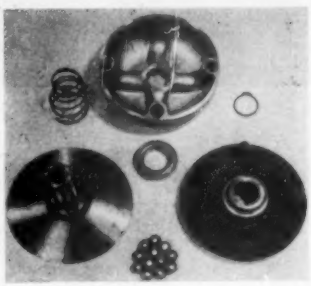
The process is suggested as a simplified spray wash and surface-conditioning treatment of metal parts before painting. Existing wash setups of three or more stages normally can be utilized without modification.

Turco Products, Inc., Los Angeles, Calif.

(MORE DATA? CIRCLE FYI 76, p. 147)

Centrifugally Operated Clutch Pulley Reduces Overload





Automatic variable-speed clutch pulley which is controlled by engine speed makes possible infinite gear-ratio changes on any kind of machinery on which a variable-speed belt can be used. The automatic clutch is centrifugally operated by steel balls which travel in channels in one pulley half.

When the speed of the engine is increased, centrifugal force of the steel balls pushes against the pulley half, forcing the pulley halves together, thereby carrying the belt up from the pulley shaft and automatically changing the engine from a low- to a high-speed ratio. When the pulley belt is resting high between the closed pulley halves of the drive pulley it is low on the secondary pulley, and the engine is in high speed. When the opposite is true the engine is in low speed.

In idling position the belt rides on an intermediate ball bearing which is said to reduce belt wear. Varying performance, reduction or acceleration of starting and running speeds, may be easily obtained by inserting larger or smaller balls, aluminum rather than steel, or by changing the number of balls in two or four channels, depending on the desired speed, acceleration or over-drive required of the engine.

Manufacturers claim only the normal horsepower required for running speed is necessary when using electric motors because of little starting overload due to constant acceleration of speed and a gradual picking up of the load. For this reason original motor costs are often reduced. A 7½-in.-dia clutch can fit shaft sizes from ½- to 1⅛-in. diameter.

Driv-way Lite Co., P. O. Box 2850, Denver, Colo.

(MORE DATA? CIRCLE FYI 77, p. 147)

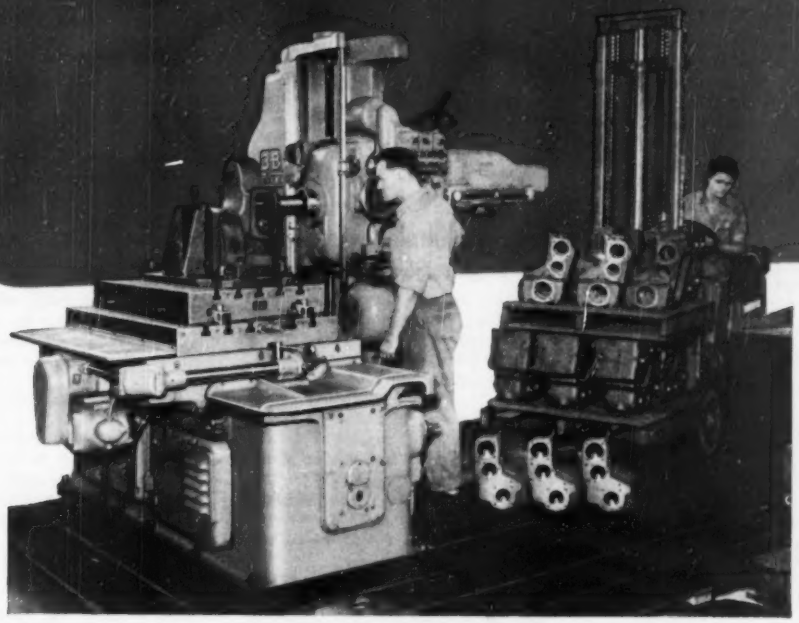
THE "JIGMIL TECHNIQUE" MAKES

JIGLESS BORING

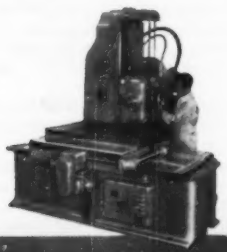
possible at

Towmotor Corporation

CLEVELAND, OHIO



This Model 3B Jigmil installed at Towmotor Corporation is used for Boring a variety of Transmission Cases in limited quantities.



- NO BORING JIGS!
- FAST PRODUCTION AND HIGH ACCURACY!
- SUBSTANTIAL REDUCTIONS IN ASSEMBLY COSTS!

Come to Detroit and Investigate the "Jigmil Technique"

Demonstrations at our Plant by Appointment

DEVLIEG MACHINE CO. 450 FAIR AVE. FERNDALE 20 (DETROIT) MICH.

DEVLIEG JIGMIL

Flexible Tubing Offered In Variety of Materials

Light-weight flexible tubing called Spiratube is available in a variety of standard plies and materials as well as specially engineered combinations. It is designed to satisfy most ducting requirements from 3- to 30-in. ID for air and other gases and powdered, granular, or other light solids. Weight is 0.64 lb per lin. ft. and retractability for 15- to 23-ft length is 87%. It can withstand vacuum up to 25 in. hg and pressure up to 170 psi. Standard types are impervious to temperatures ranging from —30 F to 250 F.

The Flexible Tubing Corp., Branford, Conn.

(MORE DATA? CIRCLE FYI 78, p. 147)

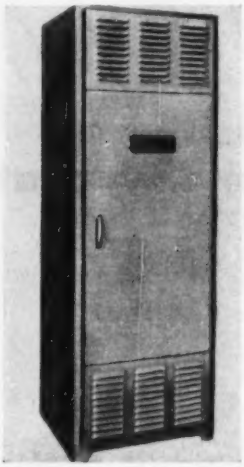
Keller Air-Line Lubricator Oils Tools Through Air Supply

Automatic lubrication for air tools using 10 to 60 cfm is provided by the Air Line Lubricator. It is made in two sizes; the larger of which is illustrated.

The bowl holds 6 oz of light oil and provides oil feed through a porous bronze wick. The quantity of oil dispensed into the air stream depends on the amount of air passing the wick. Thus, several tools operating from one lubricator will automatically draw more oil than just a single tool. Under normal conditions, pressure drop through the lubricator does not exceed 1 psi.

Keller Tool Co., Grand Haven, Mich.

(MORE DATA? CIRCLE FYI 79, p. 147)



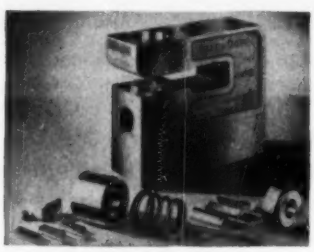
Selenium Rectifiers for Plating Sealed Against Corrosion

Oil-immersed selenium rectifier is especially designed for electroplating. It has hermetically sealed selenium stacks to withstand the corrosive atmosphere of the plating room.

Two models are 6 to 12 volts and 9 to 18 volts. They consist of a transformer, fan, and 12 rectifier stacks arranged in a steel casing.

General Electric Co., 1 River Road, Schenectady 5, N. Y.

(MORE DATA? CIRCLE FYI 80, p. 147)



Plunging Units Eliminate High Strippng Pressures

Wales Type G hole-punching units are equipped with split punches which are said to eliminate the large pressures and oversize springs which are usually associated with stripping punches out of punched holes. Three-piece punch collapses sufficiently to free itself from the wall after punching the hole. Thus only a series of small lifter springs are required to raise the punch assembly to the up position. Nothing is attached to the press ram, its only function being to depress the split-punch assembly through the work.

Same group of units may be set up on templets or T-slotted plates in stamping presses and on rails, strip templets or T-slots in press brakes. Interchangeable use of the same group of units permits setups of unlimited hole-punching patterns and fabricating parts the same day a hole-punching design is released for production.

Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y.

(MORE DATA? CIRCLE FYI 81, p. 147)

Temporary protection of metal objects, precision tools, gears, and machine parts during both storage and shipping is provided by hot metal coating called Fidelity Dip-Pak No. 532. Received in briquette form, this material is melted and applied to metal objects providing a pale, transparent, tough, abrasive- and moisture-resistant coating. It is removed by slitting the coating down the middle and peeling the skin off like a banana. The material can be used over and over again by simply remelting.—*Fidelity Chemical Products Corp., 470 Frelinghuysen Ave., Newark 5, N. J.*

(MORE DATA? CIRCLE FYI 82, p. 147)

Assortment of abrasive wheels and points mounted on ⅛-in. steel mandrels contains nine each of the 16 most popular sizes and types. These include straight wheels, cones, cups, and rounded burrs.

Schupack Supply Co., Chicago, Ill.

(MORE DATA? CIRCLE FYI 83, p. 147)

Jeweler's lathe has been mounted on a bench with a motor drive. The lathes are made with either 3/16 or 5/16 in. collet capacity and include a reversing and foot-starting switch.

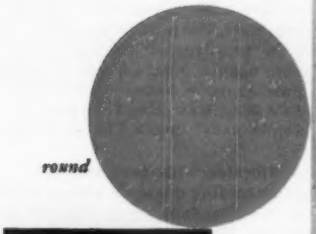
Louis Levin & Son, Inc., 782 E. Pico Blvd., Los Angeles 21, Calif.

(MORE DATA? CIRCLE FYI 84, p. 147)

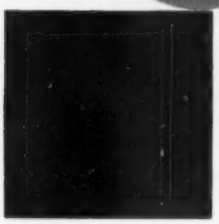
Free-machining welded stainless tube has the following analysis: carbon 0.08% max; chrome 17-19%; nickel 8-10%; and selenium 0.07% min. Tests made to date show that Carpenter Stainless 303 handles in automatic screw machines at about 70% of the speed of SAE 1020. The steel is said to have non-galling properties that make disassembly of parts easy and help avoid scratching or galling in moving parts. Only a

Ellstrom

chromium plated gage blocks wear 5 to 20 times longer!



round



square

rectangular

How'd you like to make a big dent in your gage block costs? It's simple. Just specify "chromium" . . . Ellstrom chromium plated gage blocks. They're rated "tops" for all-around gage block quality . . . wear from 5 to 20 times longer than ordinary blocks, yet cost but very little more. Made of the finest materials . . . processed under precisely controlled conditions . . . and finally finished with their extra hard gaging surfaces through methods first developed and perfected by Ellstrom to give you longer wearing millionths.

Ellstrom chromium plated gage blocks are available in 12 standard sets . . . rectangular, square, or round . . . in working, inspection, or laboratory accuracies to meet every gage block requirement. Special sets, metric sets, or individual blocks are also available upon request. And every block in every Ellstrom set carries a positive guarantee of specified millionths to give you the accuracy and uniformity you need.

Ellstrom . . . *measuring in millionths for three generations.*

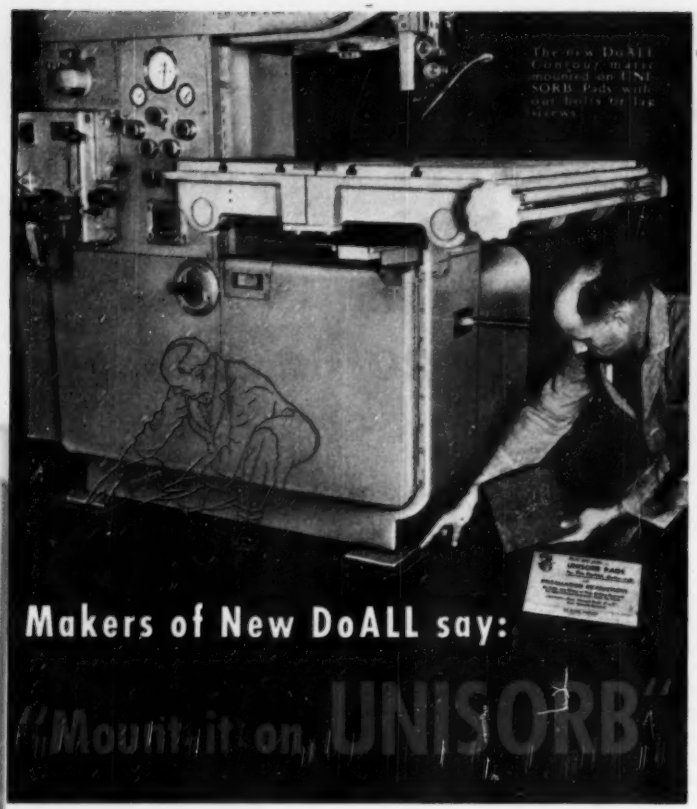
Do You Have the New Ellstrom Catalog? Contains complete specifications and prices on standard Ellstrom Sets . . . plus the new Ellstrom "Build-up" set, Internal Setting Gage, Inspection Service, and Trade-in Allowances. Send for your copy today!

For longer wearing millionths, specify **"Chromium"** . . . **Ellstrom** chromium plated gage blocks!

DEARBORN GAGE COMPANY

22035 BEECH STREET • DEARBORN, MICHIGAN

Originators of Chromium Plated Gage Blocks

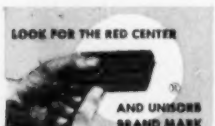


Yes, specifications for the amazing new DoALL Contour-matic cutting machine call for UNISORB-mounting.

And what could be more natural than to anchor this modern machine the modern way? For UNISORB controls up to 85% of all transmitted noise and vibration.

No drilling or old fashioned floor damage is necessary either. Unisorb cement binds the Unisorb Pads to machine feet and floor with a minimum holding strength of 1500 lbs. per square foot.

Not affected by oil or grease, UNISORB lasts for years and years *with no maintenance!*



THE FELTERS COMPANY

210-N SOUTH STREET, BOSTON 11, MASS.

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moderate amount of cold working is recommended because the steel work hardens rapidly. The tube is available in rounds or shapes from ¼ to 4½ in. OD and in all standard wall thicknesses.—*The Carpenter Steel Co., Alloy Tube Div., Union, N. J.*
(MORE DATA? CIRCLE FYI 85, p. 147)

Safco No. 1250. Hi-Temp oil is a light-colored, carbon-free, high-temperature, lubricating oil for lubrication of bearings and chains continuously subjected to severe operating temperatures. The product is said to have been "heat-treated" for greater resistance against gum, carbon, or sludge formations. — *Swan-Finch Oil Corp., RCA Bldg. West, New York 20, N. Y.*
(MORE DATA? CIRCLE FYI 86, p. 147)

A vibrator with controller for the press feeding device has been added to the standard equipment of the Stokes Model 741 completely automatic molding press. The vibrator will provide either steady vibration to more densely fill feed tubes in the loading assembly or intermittent vibration when the feeder assembly is directly over the dies and in the unloading position.—*F. J. Stokes Machine Co., 5900 Tabor Road, Philadelphia 20, Pa.*
(MORE DATA? CIRCLE FYI 87, p. 147)

Plastilube all-purpose lubricant has no melting point, and is said to possess greater adhesive qualities and excellent pumpability at low temperatures. Manufacturers say it is adaptable for virtually every automotive and industrial use.—*The Warren Refining & Chemical Co., 750 Prospect Ave., Cleveland 15, Ohio*
(MORE DATA? CIRCLE FYI 88, p. 147)

Rust disintegrating and penetrating fluid, Du-Ol is said to work instantly. The fluid contains no acids, gasoline, kerosene, or other inflammable or toxic materials. It is orderless and harmless to the skin.—*Superaite Corp., 38½ Canal Place, New York 51, N. Y.*
(MORE DATA? CIRCLE FYI 89, p. 147)

Oil and grease absorbent called Carey Asbesto-Sorb is claimed to have 11 to 16% greater oil-absorption properties than comparative materials subjected to the Gardner-Colman tests. It is classified as noncombustible by Underwriters' Laboratories, Inc., and may be used to retard the spread of fire. It is available in 50-lb cartons, contains no acids or caustic, and can be reused until thoroughly oil-soaked.—*Philip Carey Mfg. Co., Cincinnati 15, Ohio*
(MORE DATA? CIRCLE FYI 90, p. 147)

Oakite's New FREE Booklet on Metal Cleaning

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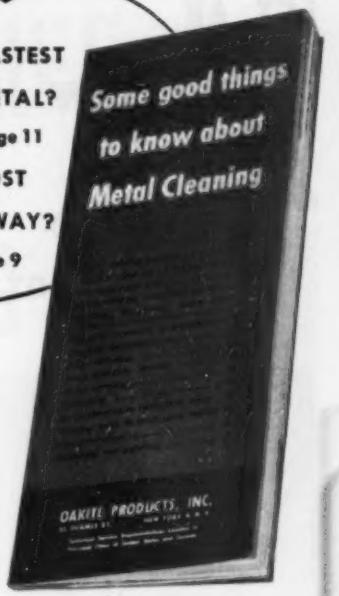
See page 11
WHAT'S THE MOST ECONOMICAL WAY?
See page 9



answers many questions that mean better production, more profit for you. Just look at the table of contents:

- **Tank cleaning methods**
- **Machine cleaning methods**
- **Electrocleaning steel**
- **Electrocleaning nonferrous metals**
- **Pickling, deoxidizing, bright dipping**
- **Pre-paint treatment in machines**
- **Pre-paint treatment in tanks and by hand**
- **Paint stripping**
- **Steam-detergent cleaning**
- **Barrel cleaning**
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Can one cleaning material do all metal-cleaning jobs? *See page 5.*

What kind of cleaner attracts both oil and water? How does this help remove buffing compound residues and pigmented drawing compounds? *See page 8.*

Why clean ferrous and nonferrous metals in separate tanks? *See page 10.*

What are the advantages of reverse current for electrocleaning steel? *See page 15.*

For electrocleaning nonferrous metals, what are relative advantages of cathodic, cathodic-anodic and soak-anodic cleaning? *See page 17.*

Can you electroclean brass without tarnishing? *See page 18.*

How do bright dips make metals brighter? *See page 21.*

Can you clean steel and condition it for painting for less than 20 cents per 1,000 square feet? *See page 26.*

Would you like a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 28.*

What's the best way to clean parts that are too large to be soaked in tanks or conveyed through washing machines? *See page 30.*

Does your burnishing barrel produce a luster you are proud of? *See page 32.*

What do you do when the overspray neither sinks nor floats in the wash water in your paint spray booth? *See page 35.*

Do you dry steel parts before anti-rusting? *See page 37.*

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ROUND TABLE Discussion

ARE PROMISES MADE TO BE BROKEN?

A STRANGE question; one which, in the purely literal sense, carries its own answer—a definite no; otherwise language is meaningless. Sometimes, however, promises are sought under conditions in which the potential promisor may not be 100% a free agent. A man whose life is in danger might promise anything to save it; a man who needs a job—means of livelihood—is not likely to be unduly sensitive about the nature or the implication of the words he may use.

Now a man has let Ed down; has broken a promise to stay with him, if given a job, in spite of all his blandishments. Alas poor Ed; that he should meet such base ingratitude. And he had intended to give the man regular work; that is, if he were capable; if he were a good timekeeper; if he were energetic; if he were reliable; if the firm's orders held good and he had work to offer; and if this, and if that, the man could have had a job for life; that is, if Ed had lived and remained foreman, and they had not fallen out. This, of course, presupposes that the man liked Ed, and his shop, etc., etc. Oh "if 'ifs' and 'ands' were pots and pans." But they are not and to a considerable degree we get just what we deserve.

It would be well if workmen elevated to foremanship rank remembered that their elevation was of position only. They are the same men, as before, wise or foolish; far-seeing or short-sighted; radiating wisdom or folly; inspiring or repelling confidence and respect. One will attract good men and hold them; others will do little more than inspire contempt; see bogeys; experience nightmares; chase jack-o-lanterns, and other figments of their own imaginations; and cry for the moon. Who are they? Their deeds and the looking-glass will reflect their features.

P. E. James
Lindum, England.

•

BACK ON THE CLOCK

ANY SUPERVISOR who feels too big to punch a time clock, the same as other workmen, feels too big, *period*. It does not follow, however, that it is wise to have him do so. The basic purpose of a clock record on any man is to know whether he is on the job on time, and whether he stays until quitting time, together with whatever psychological value there may be in having each man know that his record is always available. This knowledge and record not only make laggards conspicuous, but makes them *feel* conspicuous. Most supervisors are more or less conspicuous without relation to the clock. Therefore, any late-coming or absentee habits on their part would be readily observed, and would certainly be talked about by the men under them.

One possible advantage there might be in having supervisors punch a clock after the regular system would be what little good-will might accrue in the hearts of men working for them, since it would bring supervisors and those under

"— 'and hold it within a hundred-thousandth tolerance' was little Lord Fauntleroy's parting instruction —"

SEALED FOR LIFE

WITH A PRESSURE-TIGHT

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A major design improvement in the refrigerator-compressor industry has been the development of the permanently sealed-type compressor. Nash-Kelvinator Corporation, Detroit, Michigan produces a series of home and industrial refrigerator units utilizing this principle which provides the maximum in quiet, efficient and trouble-free service life.

At the time of the original change-over the main compressor body was designed as a Meehanite casting in order to obtain the maximum in pressure tightness, machinability, all-round casting quality and uniformity.

The Meehanite compressor body illustrated (Fig. 2) is subjected to 73 machining operations, one of which is diamond boring. Even a pinpoint defect under these conditions would cause leaking. Connecting rod bearing surfaces on this casting are held to .0005" tolerance. So close and accurate must be the dimensions that many measurements are made electrically.

All castings are, of course, pressure tested and the finished unit is forced under a 5½ ton pressure into a sealed dome.

Figure 2 – The Meehanite compressor body providing maximum properties and pressure tightness to Nash-Kelvinator compressor units.

Take Your Casting Problems to a MEEHANITE Foundry!

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Atlas Foundry Co.	Detroit, Michigan
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E. W. Bliss Co.	Hastings, Mich. and Toledo, O.
Builders Iron Foundry Inc.	Providence, Rhode Island
Continental Gin Co.	Birmingham, Alabama
The Cooper-Bessemer Corp.	Mt. Vernon, Ohio and Grove City, Pa.
Farrel-Birmingham Co., Inc.	Ansonia, Connecticut
Florence Pipe Foundry & Machine Co.	Florence, New Jersey
Fulton Foundry & Machine Co., Inc.	Cleveland, Ohio
General Foundry & Manufacturing Co.	Flint, Michigan
Gosselee Foundry Co.	Chicago, Illinois
The Hamilton Foundry & Machine Co.	Hamilton, Ohio
Johnstone Foundries, Inc.	Grove City, Pennsylvania
Kanawha Manufacturing Co.	Charleston, West Virginia
Kewaunee Co.	Milwaukee, Wisconsin
Lincoln Foundry Corp.	Los Angeles, California
E. Long Ltd.	Orillia, Ontario
Otis Elevator Co., Ltd.	Hamilton, Ontario
The Henry Perkins Co.	Bridgewater, Massachusetts
Pohlman Foundry Co., Inc.	Buffalo, New York
The Prescott Co.	Menominee, Michigan
Rosedale Foundry & Machine Co.	Pittsburgh, Pennsylvania
Ross-Meehan Foundries	Chattanooga, Tennessee
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Warren Foundry & Pipe Corporation	Phillipsburg, New Jersey

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them one step nearer a common meeting level. Another would be that relatively lax foremen might be kept on their toes a little more in arriving enough earlier and staying enough later to avoid actually waiting in line to punch the clock. The idea has been advanced of having a time clock for supervisors only, but this is doubtless psychologically unsound.

One interesting aspect of time clock application would be its use with sanctions. It might be made the general rule that men would have to punch a time clock, and when time-clock cards showed a perfect record for any given employee over a period of one month, two months, or whatever length of time was taken for a standard, he would be rewarded by public notice on a bulletin board in the plant, and possibly by some other small reward. Conversely, if and when a given employee had a record sufficiently bad according to the clock, his name might also be published, though no other penalty short of actual discharge for continued failure could logically be applied.

Clock punching by foremen is more consistent in relatively small plants than in large ones, but there is probably more against it than for it anywhere. In the occasional case where a foreman is so refractory that he refuses even to consider the necessity of setting a good example by being on the job at all reasonable times, it is highly doubtful whether forcing him to punch a clock would make any appreciable change in him.

Men higher in the supervisory scale than foremen should never be made to punch a clock, unless it be done as a corrective measure in some place where consideration of plant rules and loyalty has gone completely to seed and these factors are being disregarded to the evident present hurt of the organization. Even then, institution of any such requirement should stem from a meeting of all supervisors preliminarily held, in which the trouble is thoroughly aired, and the clock-punching idea agreed upon. Doing it this way will give a little more time for egos which might otherwise be badly wounded to adjust themselves, and to look the matter in the face with at least a degree of honesty and reasonableness.

John E. Hyler
Peoria, Ill.

•

IF THE foreman is on the job both mentally and physically, having to punch the time clock should not bother him. It is a foreman's duty

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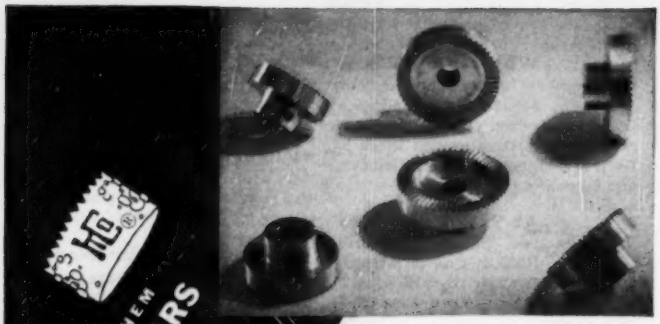

SOME CALL THEM
CROWN GEARS
SOME CALL THEM
FACE GEARS

But all gear manufacturers agree that accuracy in a gear of this type is most difficult to achieve.

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PRECISION GEAR HOBBER
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CROWN GEARS, formed on this machine, will be found to have perfect contact on the pitch line throughout the entire length of the tooth.

FILE THESE FACTS IN YOUR MEMORY

The Hamilton No. 1 Gear Hobber forms *small, super-accurate* spur, spiral, bevel, worm, and face gears. It is of extra rigid construction, and embodies the **unique feature of independent selection of speed, feed, and indexing.**

Thus—the principle of this machine (hobbing) eliminates the possibility of indexing error. The accuracy of this machine is reckoned to .0002". The rigidity of this machine *maintains* accuracy and encourages heavy production loads. The principle of independent speed, feed, and indexing selection, embodied in this machine, cuts set-up time far below previously acknowledged minimums, and permits higher production on relatively soft materials without indexing change.

We will be glad to supply engineering information about the application of the Hamilton No. 1 machine to your particular job. **Also ask for our Bulletin H 1-49. It illustrates and explains the Hamilton No. 1 Gear Hobber in detail.**

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to be on the job when the shift starts and he should be one of the last to leave. Many foremen took advantage when they did not have to punch the clock and abused the privilege. Someone once remarked, "A man's head is like a pin; it keeps him from going too far."

At one plant, employees worked until 5 pm and the foreman until 5:30. The very foreman who insisted his employees work until the last minute was the foreman you would find lined up at the clock waiting for the bell to ring. Any foreman who has an employee ring his card for him is totally uneducated, no matter how learned he may be in other things. He is setting a bad example for the employees. Al's actions in this instance remind me of an article published many years ago in the *Boston Transcript*.

Here lies the body of William Jay
Who died maintaining his right of way—
He thought he was right, dead right, as he sped along,
But he's just as dead as if he were wrong.

The foreman or the employee who is resentful about having to stand in line are those who get in the last minute and want to be the first to leave.

A. E. Salmons
Philadelphia

•

MY OBSERVATIONS from having worked in plants employing less than one hundred to others where several thousand were employed is that punching the clock is a good thing for all concerned. While it has a different meaning for those who are paid for the hours worked from those who work on a salary basis, the most satisfactory feeling was found to exist in a plant where something fewer than 1000 were employed, in which every one including the president of the company registered their time in and out on the clock.

A foreman for one reason and another finds it necessary to put in some time before the regular starting time at the beginning of his period of work and more often after the regular hours of work at the end of his period, for which he receives no extra compensation except such as may have been provided for in the establishment of his salary.

However, it is well that there is a record kept of his total time for reference that he may be given due credit for his service.

The fact that every one uses the clock tends to break down any bar-

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SQUARE D CONTROL CENTERS have provided substantial space savings in 70% of recent installations. The compact design of Square D starters and circuit breakers permits side-by-side mounting through SIZE 3. Free standing vertical sections have mounting provisions for individual control units built to minimum heights based on 3" steps. Each section has 78" height available for units. SIZES 1 and 2 non-reversing starters are 12" high; SIZE 3 is 15" high.

The control center illustrated above shows typical Square D space economy. The following is incorporated in only 188" L x 90" H x 20" D:

SECTIONS 1 AND 2 *(left to right)*—three starters and one space for 75 H.P. motors.

SECTIONS 3 THRU 7—two-speed starters for five 15/3.7 H.P. and two 30/7.5 H.P. motors. Starters for five 30 H.P., four 10 H.P. and two 2 H.P. motors. Three 50A frame branch circuit breakers.

SECTION 8—Six 50A frame branch circuit breakers.

SECTION 9—Three reversing starters and one space for 7 1/2 H.P. motors. (Pilot lights and push-buttons are mounted in covers without increasing standard unit sizes.)

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Plug-in starter units slide on guide rails at four corners. Spring backed, silver plated stab fingers grip round vertical busses.

Safety Disconnect handle mechanism locks both door and disconnect with one to four padlocks. On closing unit door, handle moves to indicate ON or OFF.

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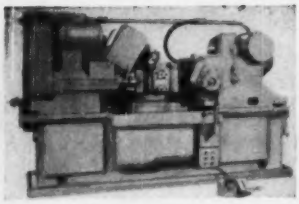

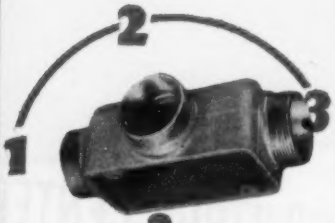

The outstanding advantage of this machine is ability to handle operations on one, two or three ends of a piece simultaneously or in sequence, *without changing set-up* or rehandling. It is the only standard machine that will do this.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence—a method exclusive with Goss & DeLeeuw and offered on this machine.

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riers that might otherwise come up between different grades or classes.

As for any person to punch the clock for another, that is dishonest and should not be tolerated under any circumstances. Each of the parties is guilty.

To derive all the benefits that can be obtained from the use of the time clock all should use it, as it shows each individual rating, and in the long run furnishes evidence for justice.

John Mark May
Watervliet, N. Y.

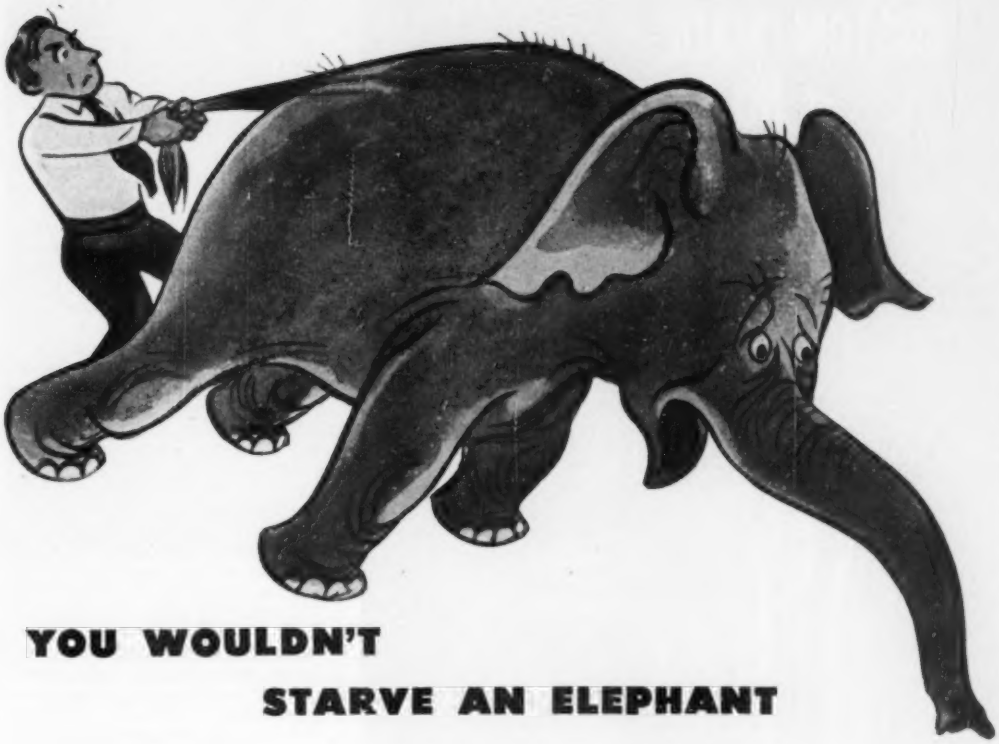
•

BY APPOINTMENT ONLY

THE WORKER today is well informed concerning his rights and his position, and is in a frame of mind to demand proper consideration of his opinions, requests, and grievances. The foreman, as the line officer on the firing line of production, finds that his responsibility is now about evenly divided between the material and the human sides of production. This is why a formal conference in the shop office, by appointment only, is the most effective way to handle individual personnel problems.

The appointment system seems simple enough. If the foreman is too busy at the time a worker wants to discuss a personal matter with him, the man simply enters his name on the appointment list so that the foreman can take his problem up individually and can devote his full attention to it. This system of individual appointments will not only aid the foreman to arrive at a more carefully formulated answer but will enable him to see more men during the day by planning it that way. It actually enables the foreman to give more time to each man instead of haphazardly trying

"Sure, I'm careful—I'm wearing safety shoes and gloves, ain't I?"



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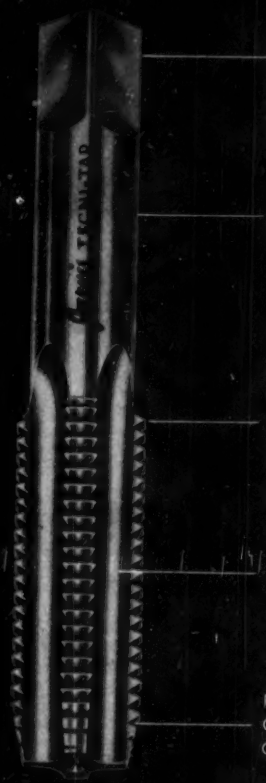

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FLEXIBLE SHAFTS and
QUICK CHANGE CHUCKS and COLLETS

THE CHARLES L. JARVIS CO. MIDDLETOWN IN CONNECTICUT

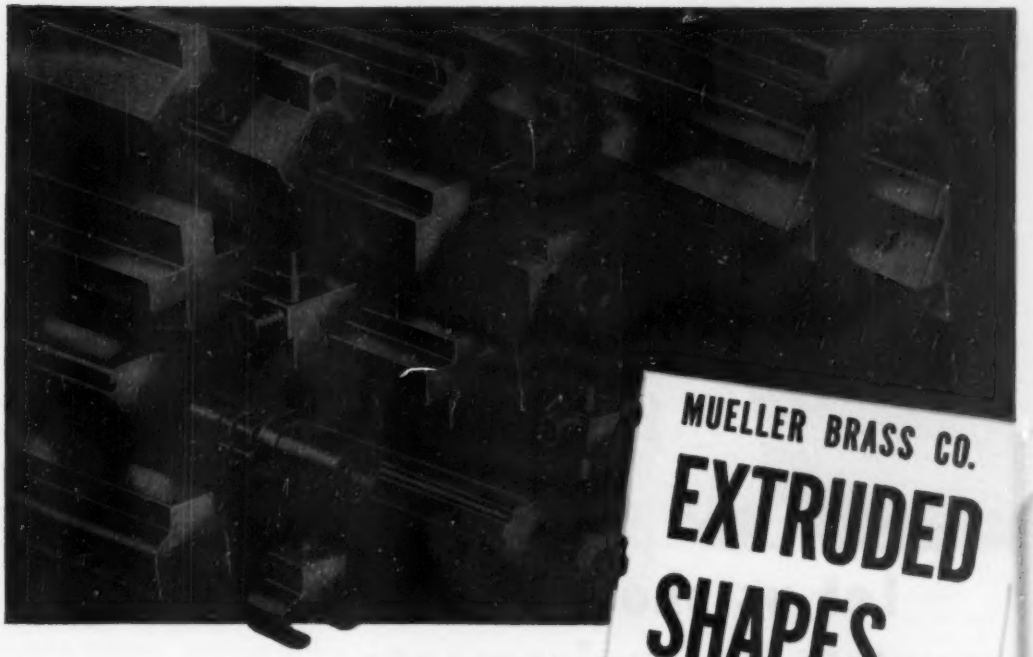
to answer two different workers' problems at one time with possible detriment to both of the workers.

The appointment list for dealing with the workers' problems is a good planning device. It insures that all problems will obtain proper consideration and adequate solutions will be formulated. It is not enough for the foreman to know what he is going to do during the day. It is important for him to know how he is going to do it and when it is to be done. Trying to handle too many problems at one time will not permit proper attention to be given to any one of them. Before he knows it the foreman will be spending too much time trying to get out from under. Planning appointments with workers can be carried a step further. The foreman should plan his entire day's activities, if possible.

Some foremen will say that all this discussion about planning and appointment lists is applicable to top executives whose time is their own to plan, rather than to men like themselves who must be on call from other people, either superiors or subordinates. Even so, the foreman can establish an appointment list as part of his daily planning to fix the order of attention, importance, and amount of time for different demands. The appointment list for handling employees' problems makes for stability in the foreman's day. Routine and recurring experiences can be handled effectively, and individual attention to specific problems will assure that they are satisfactorily answered. The good foreman considers his workers' problems as important as his own, and deserving of his important consideration.

A formal conference in the office, through the appointment list, is the best way to handle any grievance or problem. When the worker comes with a grievance, he is usually under a nervous strain. He may have given considerable deliberation to his problem before he finally decided to take it up with the foreman. He should therefore be sincerely welcomed and put at ease. There should be no one else in the office at the time of the interview. The foreman should let the worker know that he has plenty of time to tell in private whatever he wishes, and that anything he says will be confidential. The worker has come to the foreman about a matter that is serious to him. The conference will give the foreman the necessary opportunity to properly analyze the case, and arrive at a solution.

In actual practice, the appointment list will be found to provide the



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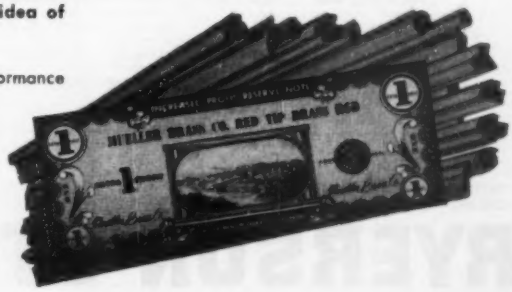
Mueller Brass Co. Red Tip Brass Rod is a universal, many-purpose, extra-fast cutting Rod. Its constant uniformity saves tools, grinding and "down" time. It actually can be machined at greater speeds than that of which any machine is capable on a continuous production basis. YOU CAN PIN MORE PROFIT TO YOUR COST SHEET BY USING MUELLER BRASS CO. BRASS ROD AND EXTRUDED SHAPES.



MUELLER BRASS CO.

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necessary device to insure the full attention of the foreman to the worker's problem. Once this method is established, it will encourage employees to go to the foreman for his advice when they need it. It will help build good morale.

Harry Kaufman
Philadelphia

•

AN APPRAISAL of the advantages of giving workmen ready access to their foreman at all times should be made before coming to any specific decision to do so or not to do so. There are some plants in which such ready access is far more necessary and valuable than in others. Too, it is well to make some appraisal of the habits of the specific group of men employed in a given department before coming to a specific decision in this. We are all acquainted with men who have a healthy degree of self-reliance and who are sufficiently mature that they will avoid going to the foreman with matters that are trifling and insignificant. We are all acquainted with men who wax exceedingly verbose over such light matters, pestering the foreman and expecting him to hand down a carefully considered opinion or order for varying phases of practice which really matter but little.

If and when a department contains only men who do not (knowingly or unknowingly) abuse the privilege of direct access to a foreman, it will be much better to provide the easy-going regime if possible. In those rare cases where a foreman chances to be besieged with two or three men at once, he can simply ask one or two of them if they will wait until he has taken individual care of prior questions and matters, and then explain, when he gets to them, that he wanted to give them individual and undivided attention in turn. If he follows such a regime, most of his men will soon come to understand, and will, if at all possible, avoid bothering him at a time when he is seen to be already occupied.

The degree of success with which a man can employ the "By Appointment only" technique usually varies with his individual bearing. If and when he is one of those individuals who can do a thing of that kind without appearing chesty or exhibiting a manner of more-than-ordinary importance, it may work out fine. If he is the type of supervisor who somehow generates a considerable amount of animosity in the hearts of his men on general principles, instituting such a system will result in much resentment. His men may

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Take the operator who has his hands in coolant all day long — give him Lusol that is clear and clean — like a mild soap solution — no skin irritation — a clean machine — a clear solution that allows him to see his work as the finest drill comes down to the work piece — perfect vision — easier to work with — it changes the whole working aspect of a shop — clothes and shoes no longer soaked in old type coolants. Add to this fewer tool changes, less wheel dressing, far greater speeds, and production picks up with less effort, less operator fatigue. We've never found an operator yet who wants to go back to the "old way."

A bar of 18-8 stainless steel was being cut in 20 minutes. When Lusol was used with the same size bar, same material, same operator, same machine, same tool, the cutting was done in 2 minutes.

Hard to believe, and all Lusol results are hard to believe unless you can accept an entirely new concept of the use of coolants. Lusol cools —rather than lubricates. On the case above, speeds were increased from 30 RPM to 267 RPM. Previously the operator had been breaking tools with fair regularity. Since using Lusol he has broken none. Old type coolants had kept the operator constantly annoyed with skin eruptions. Since using Lusol he has had none.

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Sooner or later someone is going to ask you why you haven't checked into Lusol before. Sooner or later you are going to find out that it does just what the first 10 million gallons have proved. Investigate this way to improve your production NOW. It's more profitable to lead than follow.

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CASE HISTORIES YOU CAN'T AFFORD TO OVERLOOK

Lusol

SAVES TOOLS ▾ SPEEDS WORK
CUTS COST

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UNITED STATES STEEL

then manage to twist his inaccessibility into an alibi for practically every mistake or unfortunate thing taking place. It would be much better to have a foreman distracted now and then by two or three men trying to question him at once than to have his department in general at odds with him.

If it is at all possible, someone with at least a modicum of authority should be accessible at all times, just in case some problem that is really important does arise. Realization of this principle long ago gave rise to use of a "straw boss" in many dpartments, who would take over to the best of his ability during absence of the regular supervisor, or when the regular supervisor was already occupied. The shortcomings of the straw-boss idea are too well known to need any elaboration, but it is probable that in many plants and departments, flexibility advantages gained through having one outweigh all attendant drawbacks.

John E. Hyler
Peoria, Ill.

•

FIFTEEN minutes of uninterrupted time given to each of his men will be beneficial to the interest of the foreman and the worker. True it is that a foreman has his hands full at all times, but a heart-to-heart talk with his men would relieve him of many an unnecessary burden at a later time.

There is one caution, however, that should be exercised: these conferences must be business-like and it is up to the foreman to hold the reins as to the time necessary to complete the issue at hand. There is a decided difference between a discussion and an indeterminate blab-fest. I should think that once a month would be sufficient for these get-togethers — that, of course, would depend upon the amount of men in the crew. I am certain that these conferences would repay immeasurably in better understanding.

Were the men to know that each would be given an opportunity to confer in private, and they knew in advance when their appointment would take place, they would be wide awake to the opportunity presented to them. I am certain that the men would become conscious of the import of this conference and strive to make the most of it by making notes of the subjects to be brought under discussion.

It may be that one of the fellows has personal troubles that should be known to the foreman in order that

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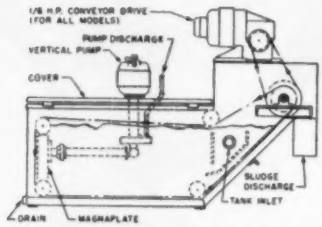

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he may better understand the man. The worker would certainly hesitate to reveal any troublesome thing within the hearing of his fellow metal-buster but the conference idea would enable him to open up without any hesitation. An example to bring this to rock bottom basis would be the fact that the poor chap's wife is destined to become the bearer of a future toolmaker. There is no doubt that domestic difficulties do have their effects upon the peace of mind and the efficiency of the worker. Were the boss to know of these things he certainly would be sympathetic and cooperate whereas in ignorance he would say: "What in hell's the matter with that guy; he's slipping."

I have been on a job wherein I hungered to have a good talk with my boss, but couldn't see any way clear to have it. I certainly did not cherish the hit-and-run method, such as interfering with the boss's time when he was busy with other things. I know there would have been a better relationship between us, we would have been able to understand each other better, and the hidden problems would have been brought to light and dealt with in time to do some good.

Now, how about the definite advantages to the foreman? The men would understand his problem better because he could let them in on information they otherwise wouldn't vantages to the foreman? The men get. The foreman could detect many causes of dissatisfaction between the men, and between the men and himself, and be able to effect remedies before they become too big for comfort. The shop leader could be in a favorable position to detect any undercurrent so destructive to a

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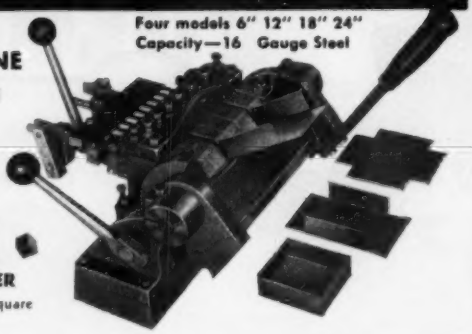

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J. Homewood
Ontario, Calif.

WE ONCE had a works manager who locked his door to everyone, even the president of the company. When you would try to see him his secretary would say he was busy or in conference. She would then ask if you wished to make an appointment. Many of the things that were important had to wait. The others that could wait were taken care of. This caused considerable discord and resentment and this works manager did not last long. The superintendent or works manager can lock their door at any time if they desire privacy. However, they should be available when needed.

The works manager has the authority to solve many of the knotty problems involved in business, production and quality. The more he has to do, the more he is able to accomplish. It has been my experience that when the executive closes his door to everyone except those who have an appointment, they will go to some other office. The executive should find the time to make the staff serve him to avoid by-passing. He must also seek the opportunities to be of service, and increase his prestige. The good supervisor is an expert at looking for opportunities to serve. After all his position is similar to that of a manager of a baseball team. The plant must be run human-wise as well as engineering-wise.

A. E. Salmons
Philadelphia

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(Continued on page 184)

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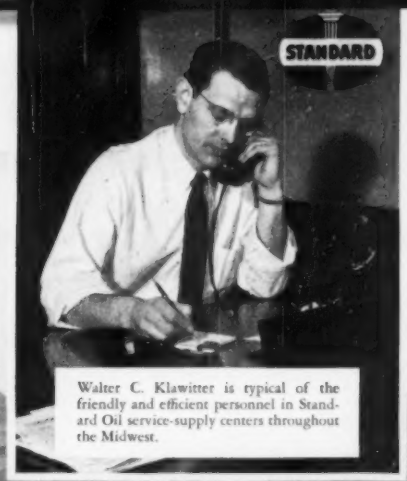

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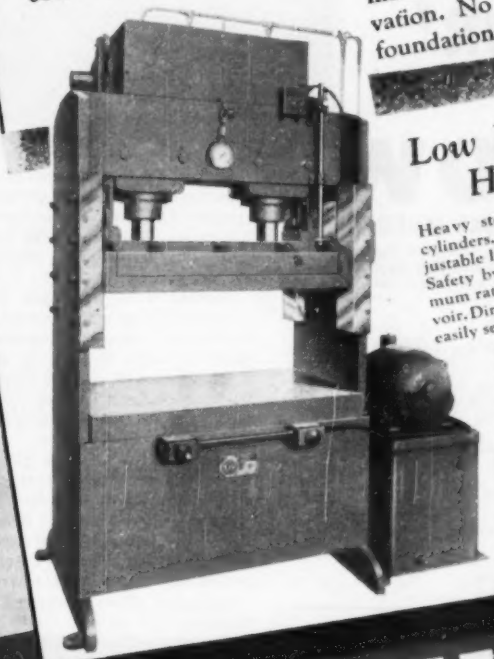

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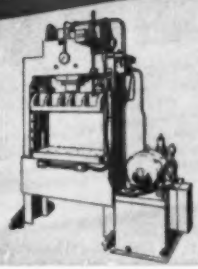

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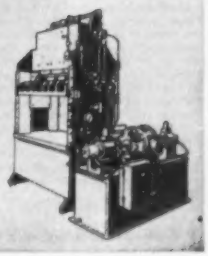

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Fixture—#15 Vertical index
Equipment—#1-UD Drilling Machine

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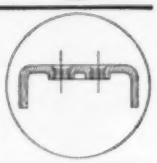
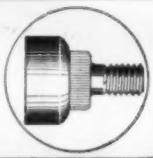


Tap Two #10-32 Holes
Material—Steel stamping
Production—3800 tapped holes per hour
Fixture—#14 horizontal index
Equipment—#1-UT tapping machine

THREADING



3/8"—24 Thread—1/2" Long
Material—Die Cast Aluminum
Production—2500 per hour
Fixture—#10 Drum dial
Equipment—#3-TR Threading machine

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Submit Sample Parts for Production & Cost Estimates

demand for it indicates not only the worth of the original text but also the growing need for reference material as the pressed-metal industry expands.

This edition thus serves a number of purposes, the two most important being: (1) as a reference to users of 200,000 Bliss presses now in industry, and (2) as a guide to operation of presses and dies. The very large number of good line drawings is an outstanding feature of this Handbook.

The book contains six sections:

Section I — 100 pages on power-press operations, crankshaft ratings, selection of the proper press, die cushions, and reference tables.

Section II—50 pages of press illustrations and notes on types of work for which they are best suited.

Section III — 59 pages on Bliss-Marquette die cushions and complete information on determining size and type.

Section IV — 409 pages of service information on Bliss presses and components. Each item is thoroughly illustrated, and complete information given on ordering replacement or spare parts.

Section V — 22 pages covering comparative press numbers, shaft diameters, tonnage ratings and other items of value to owners, tool and die engineers of shops having Bliss-built machinery bearing the Bliss, Toledo, Consolidated and Marquette trademarks.

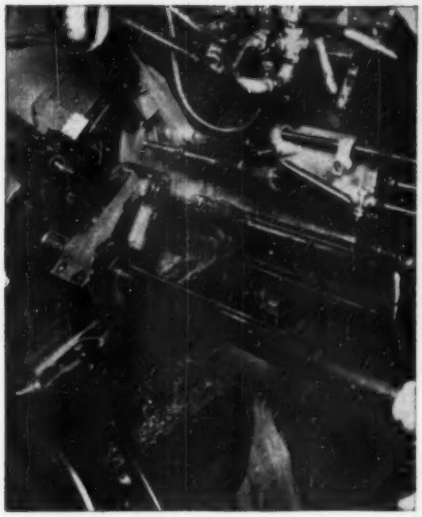
Section VI—a 51-page glossary of terms and expressions that are used in the pressed-metal industry. This glossary should prove helpful to firms dealing with companies in other localities, because many terms are of local derivation, whereas the meaning of others is colored by the nature of industries served.

The new edition of the Bliss handbook has been very thoroughly and carefully compiled not only from experience with earlier editions, but also from sound knowledge of modern requirements of the pressed-metal industry. One or several copies are needed in any shop doing stamping work.

•

ASTM SPECIFICATIONS FOR STEEL FLAT PRODUCTS. *204 pages. Published by the American Society for Testing Materials. 1916 Race St., Philadelphia 3, Pa. Price $2.25.*

Thirty-nine specifications cover plate, strip, sheet and related materials for structural purposes, boilers and pressure vessels, plus corrosion-resisting steel, wrought-iron plate and sheet,



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metallic-coated iron and steel sheets. These standards are reprinted from the 1949 Book of ASTM Standards to provide in compact form the appropriate data on flat-steel products, to write purchase and testing specifications.

•

PLANT LAYOUT AND MATERIALS HANDLING—*By James M. Apple, associate professor of industrial engineering, School of Engineering, Michigan State College. Published by The Ronald Press Co., 15 E. 26th St., New York 10, N. Y. 367 pages. Price $5.*

This book gives in detail the steps required to originate, develop, and install layouts for factory or office. Emphasis is placed on coordination between plant layout, materials handling, methods engineering, and production control and planning.

Numerous illustrations demonstrate forms and charts employed in practice to aid in establishing relationships between operations and in developing patterns of material movement. A large appendix includes such data as ASME standards on plant-layout templets and models, floor load ratings, and conveyor horsepower requirements. An extensive bibliography also is listed.

•

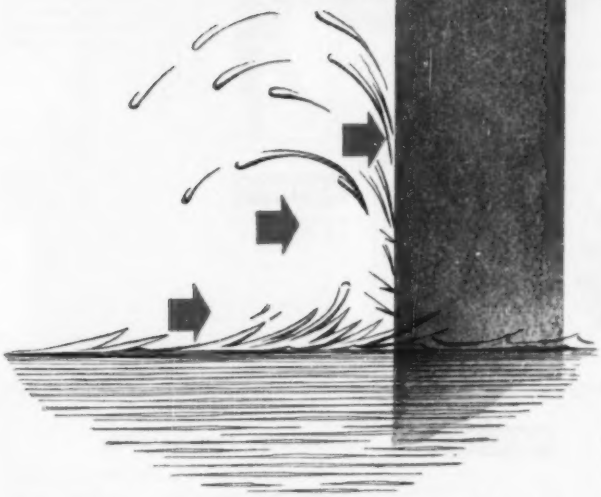
RATING EMPLOYEE AND SUPERVISORY PERFORMANCE—*Compiled by M. Joseph Dooher and Vivienne Marquis. Published by American Management Association, publication service department, 330 W. 42nd St., New York 18, N. Y. 191 pages (paper bound). Price $3.75.*

Intended primarily for the executive who must set up and administer a merit-rating program, this book treats the subject under six major headings: basic principles and techniques of merit rating, in which conventional methods are detailed and the forced-choice performance report is explained; toward more scientific rating, which includes the validity and reliability of rating and discusses methods for greater objectivity in rating; special adaptation of merit rating, including a point management-labor program; company case histories; and applying the results of merit-rating.

The book draws from the best material so far published by AMA on the subject and includes the work of fourteen people who are well-known in the field. Also included is a section presenting 26 forms used by industry for merit rating.

Where EROSION is a problem . . .

GUN IRON CASTINGS



The hardness and dense, close-grained structure of Gun Iron is ideally suited to give long resistance to erosion or corrosion. When required, this resistance can be further increased by heat treatment and/or proper alloys.

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Hunt-Spiller casts and machines parts for a wide variety of applications in metalworking. A few are shown below:

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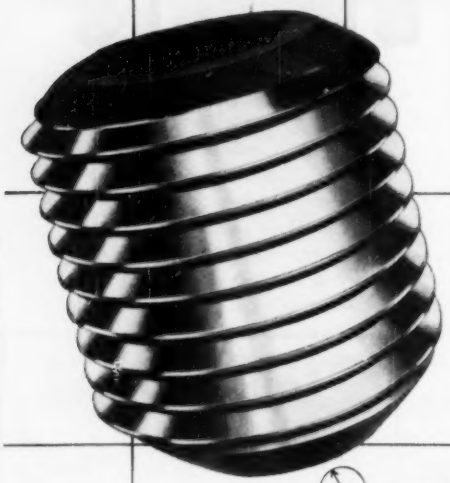
Give every department A LIFT



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Ground Thread smoothness and accuracy plus faultless thread contour and lead make P-K Socket Set Screws first choice for a high quality product.

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Free from nicks, burrs and tool marks, P-K Ground Thread Socket Set Screws are consistently uniform and are made to close tolerances. Therefore they start easy, drive easy — keep assembly humming.

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With a dependable Class 3 Fit, every P-K Socket Set Screw is made of high-grade alloy steel, heat-treated to withstand severe torque and compression loads.

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See and *feel* for yourself the difference thread grinding makes. Try them once, and see why so many Socket Set Screw users are switching to P-K. Parker-Kalon Corporation, 200 Varick St., New York 14, New York.

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Ground Threads, heretofore available only in precision equipment, provide an extra sales feature any shrewd buyer appreciates.

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FLAT HEAD SOCKET CAP SCREWS • SIZE-MARKED SOCKET HEAD CAP SCREWS
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On countless jobs—Kent-Owens Milling Machines have shown ability to turn out work with top speed and high accuracy. They're designed for rapid, easy set-up and operation. Rugged . . . with twin-post head mounting that assures balanced load—no chattering. Practical features throughout to help you *produce more* . . . with *lower costs!* Write for bulletins on the Kent-Owens Standard line . . . including wide range of hydraulic and hand operated machines. Also, let our engineers help you with tooling and special machine requirements.

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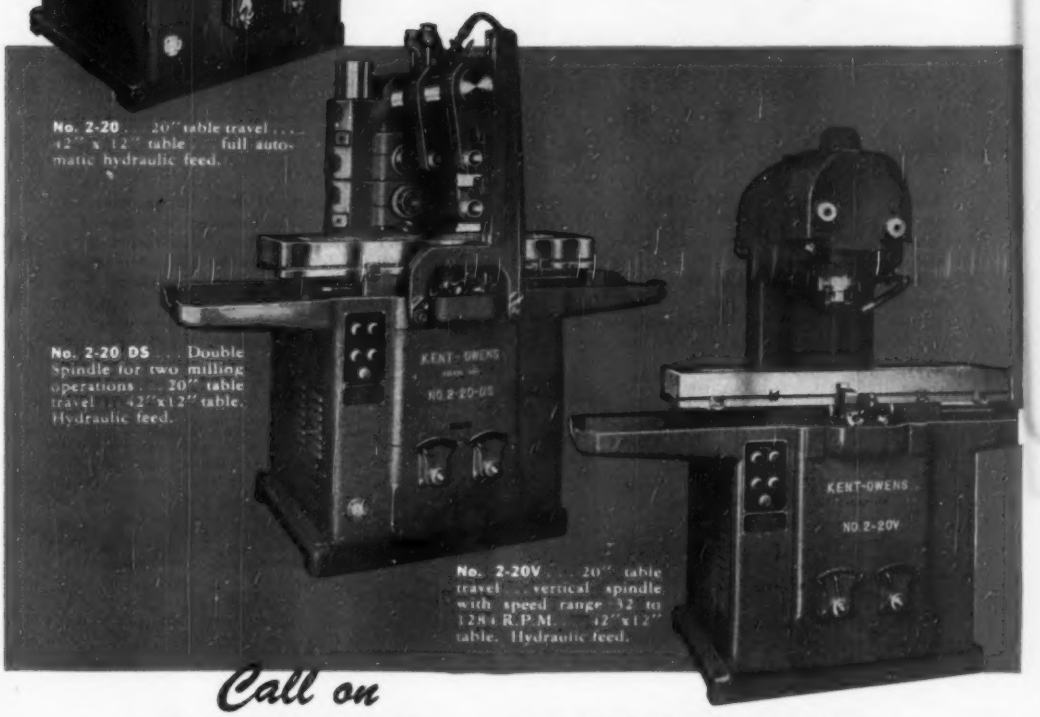

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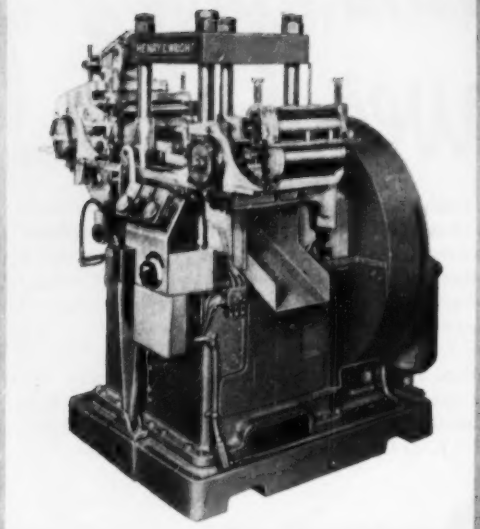


DOLLAR-PINCHING ON STAMPINGS

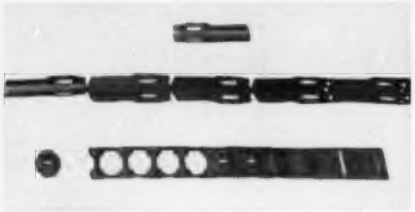
H. L. Judd Company uses Henry & Wright machines to keep production high, scrap percentage low.

H. L. Judd uses a group of 25-ton Henry & Wright machines for small, intricate stampings from light and medium gage material in coils. Larger machines (60-ton, 75-ton, 100-ton and 150-ton) turn out more complicated pieces from medium and heavy gage coil stock.

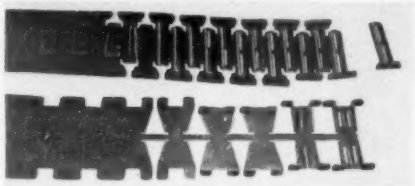
Using a battery of Henry & Wright dieing machines for more than 25 years, H. L. Judd Company, Wallingford, Conn., manufactures 300 different drapery hardware items, plus other products. Judd has found marked savings in producing lots from 5,000 up in these machines. Metals used are brass, stainless steel, carbon steel and aluminum. Gages range from light to heavy (.109 in.).

Versatility — you said it! But there's more. As the photos show, scrap losses are at a minimum. And H. L. Judd has found that Henry & Wright machines live up to their reputation: high-speed production and long die life — a combination unique with Henry & Wright machines. For economical stamping production, specify Henry & Wright. You'll scrap less . . . produce more . . . at less cost.

Small, intricate, drawn and formed stampings are turned out completed singly and in multiples at high speeds.



More complicated stampings are produced complete by Judd at rates in excess of 120 per minute for crane bracket (bottom) to approximately 500 pieces per minute for other parts.



For more details on Henry & Wright Machines, please write for catalog.

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A quick test on this new Red Ring Gear Sound Tester, equipped for air clamping, tells you immediately whether or not you have any noisy gears which will need additional processing before they are assembled into automatic transmissions.

The gear being tested is slipped onto the upper arbor and its pinion onto the arbor below, with a C-washer following each. Touching the air control lever locks both in place for the sound test which is run forward and reverse at various speeds and loading. Both gear and pinion are demounted just as easily after the test.

The gears are clamped by a predetermined spring pressure for positive safety under test. The compressed air is used to release the spring pressure for quick loading and unloading.

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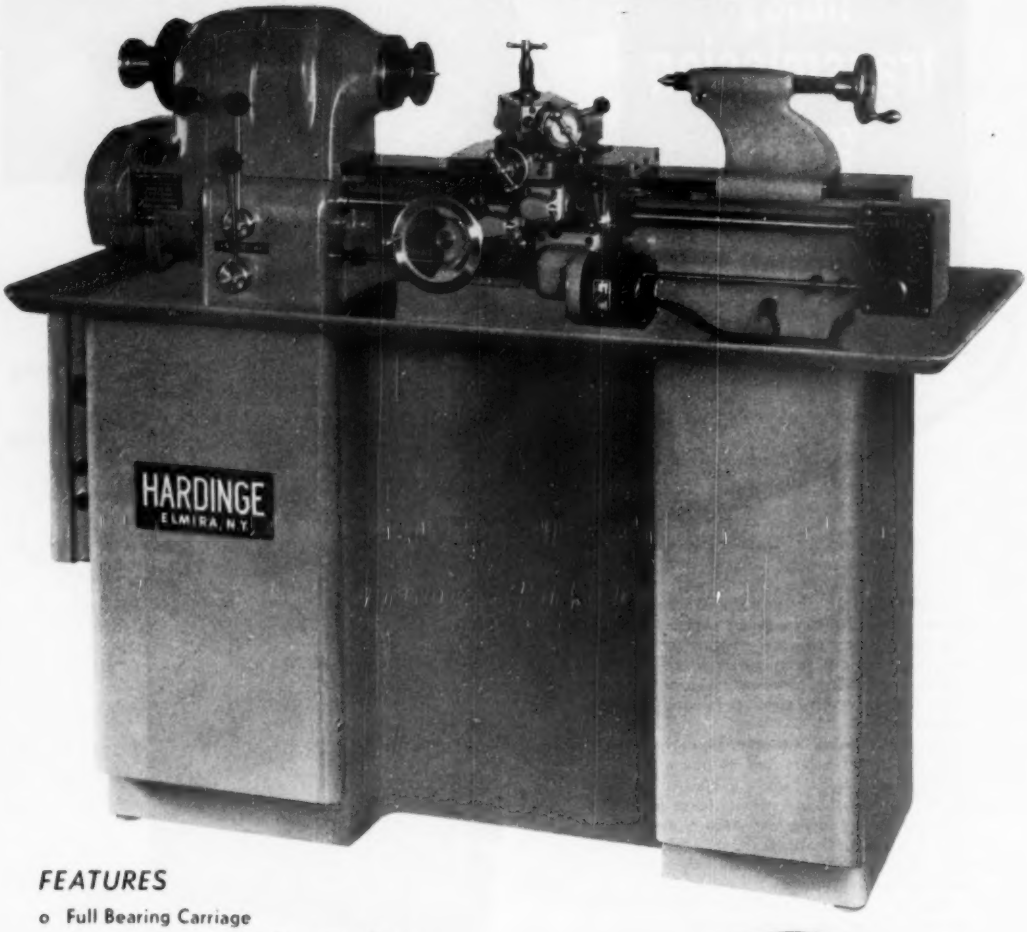
BUILT TO TAKE ADVANTAGE OF CARBIDE CUTTING TOOLS AT HIGH SPEEDS



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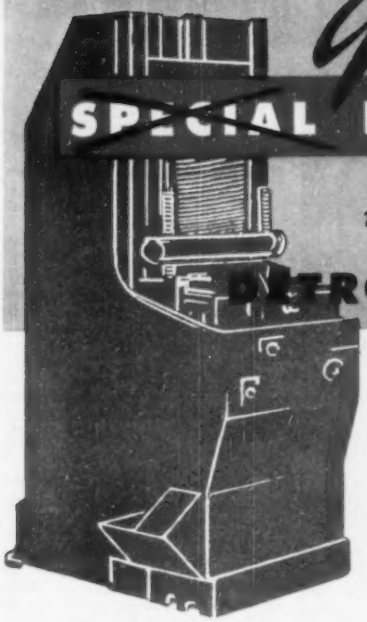

General SPECIAL PURPOSE MACHINE through DETROIT BROACH TOOLING

THE SPEED, ACCURACY AND EFFICIENCY OF BROACHING CAN BE APPLIED TO MANY GENERAL PURPOSE JOBS IN *Your shop*

The slab broaching set-up at the left is one in use in Detroit Broach's own shop. As shown in this illustration, it is used to face the ends of broaching tool blanks of widely different thicknesses, widths, and lengths. It is many times faster than any other method, guarantees squareness of the ends and produces a fine, smooth finish.

This illustrates how universal-type tooling can make it possible to apply broaching economies on parts that are not mass produced. Detroit Broach has engineered and built tooling for many manufacturers who broach a number of similar parts with one set of tools. Also, it is quite often possible to increase the work load of present broaching equipment through the redesign of tooling on this principle.

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WITH Hanson-Whitney *Precision* THREAD COMPARATOR

This precision instrument, expressly designed for production gaging, has proven itself since 1945 in checking all forms of threads including critical aircraft threads . . . and is now available to producers of external threads from 0 through 3⅛" diameter, coarse or fine pitches, in all classes. (Class 5 should be specifically requested.)

The indicator tells at a glance whether your product is over-size, undersize, eccentric, tapered, or if lead error exists. The work is recorded visually to accepted ring gage tolerances thus eliminating the human error-possibility of "feel".

Checking up to 20 pieces per minute . . . 3 minutes to change thread dia. units . . . means lower costs, greater flexibility, for both production and inspection departments.

FAST

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ECONOMICAL

1. Indicator is equipped with tolerance hands and is graduated in tenths of thousands. Any type indicator with ⅜" shank may be used.

2. Comparator easily set to desired reading by loosening knob and lowering indicator. Tighten knob screw to lock indicator in correct position.

3. Lever controls positioning of upper anvil. Can be easily raised or lowered to insert or remove work. This action eliminates excessive wear on anvils.

4. Comparator is easily set – insert setting plug, lower upper anvil. Set indicator at tolerance required.

5. Thread anvils are actually a split internal thread member to check assemble-ability and to give exact reading on indicator dial of part checked within .0002 accuracy. Anvil core hardened to 60-62 "C". Standard unit will check any P.D. from class 1 to 4 and only one set plug (of known P.D.) is required for all classes.

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Complete gaging unit may be removed by loosening screw for change in size setting. Can also be used after removal for checking parts on machine. Complete removal and resetting accomplished in less than three minutes.

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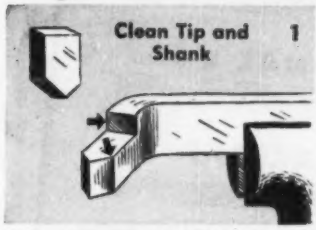
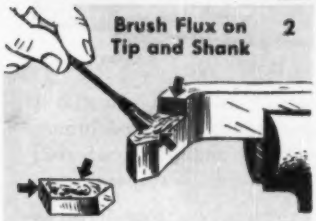
Bulletin shows detailed various parts of the H-W Comparator (all available separately). Send for your copy today.

BHW50

HOW TO MAKE YOUR OWN TIPPED CUTTING TOOLS

The sketches below show how easy it is to make your own tools by silver brazing HAYNES STELLITE tool tips to steel shanks. There are 14 standard shapes of these tips stocked for immediate delivery. Write for a copy of "HAYNES STELLITE Metal Cutting Tools" which illustrates the sizes and types of tool tips available (use the convenient coupon below). You will find prices considerably lower than for solid or welded tip tools.





1. Clean both the tip and the recessed area of the steel shank by light grinding if necessary—then brush with carbon tetrachloride. Clamp shank in vise with bottom surface of recess level.

2. Brush silver-brazing flux generously onto the joint surfaces of both tip and shank.

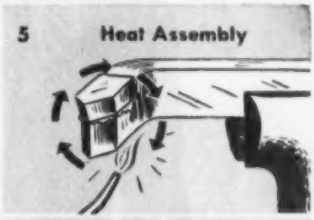
3. From 0.003-in. thick silver solder strip cut pieces slightly over-size for the joint faces of the recess.

4. Position the brazing alloy strips and place the fluxed tip in the shank recess ready for heating.

5. Use an oxy-acetylene blowpipe with a reasonably large tip and adjust for a reducing flame. Heat the shank underneath the tip to a cherry red, rotating the flame from bottom to side to top to other side to bottom. (For large quantities of tools, you can do this heating in a furnace at approximately 1450 deg. F.)

6. When the silver alloy melts, move the tip with a rod or tongs into exact position, and then press it just enough to squeeze out excess flux and silver solder. Allow the assembly to air-cool. *Do not quench!*

7. When the assembly is completely cool, remove the excess flux and scale. The tool is now ready for grinding.



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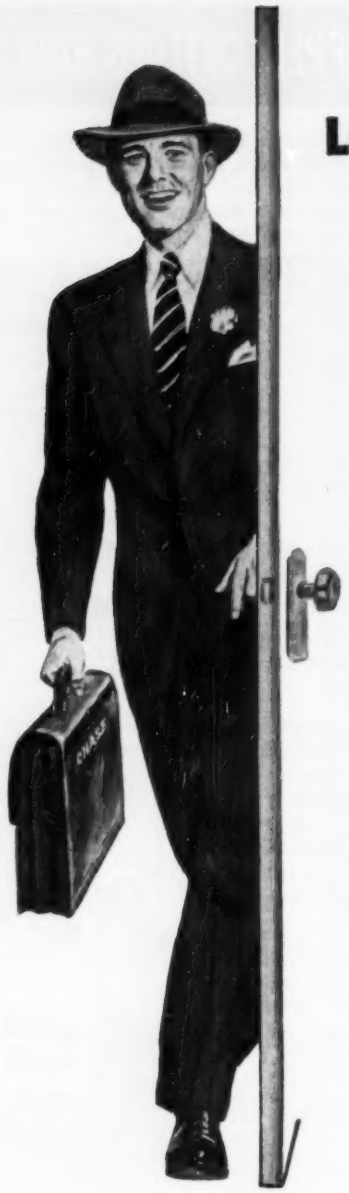

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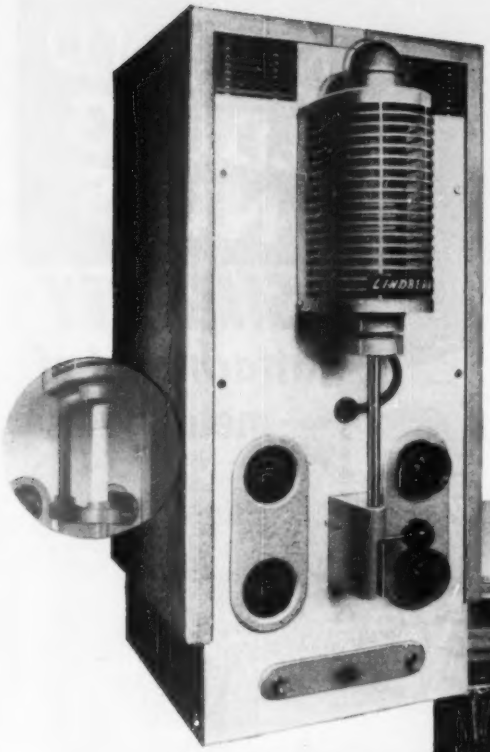
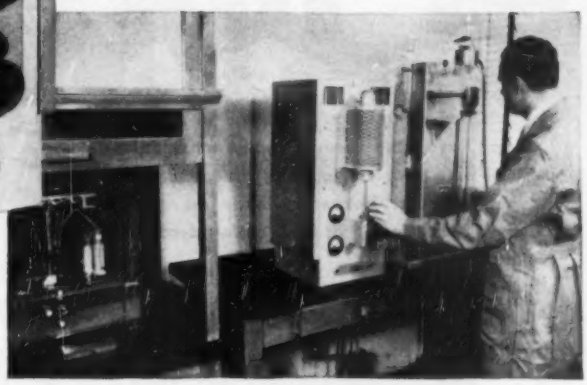


INSTANT IGNITION

of Solid Samples



Typical laboratory installation. A Lindberg Volumetric Carbon Determinator operating with a Lindberg "H-F" Combustion Unit

The Lindberg "HF" Combustion Unit is revolutionizing carbon and sulphur determinations in laboratories throughout the country. Ready for instant use—instant temperatures above 3000° F.—for steel, cast iron, alloys, or stainless samples—volumetric or gravimetric!

A high frequency unit specially designed for the laboratory

- Ready in the morning in 57 seconds—instantly from then on.
- 90% less power consumption (maximum input 0.125 KW idling).
- Glass combustion tube provides visability of operation.
- Combustion tubes at half the cost, last many times longer.
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- No elements to burn out or limit temperatures.
- Heats nothing but the sample.
- Eliminates excess heat from the laboratory.
- Inexpensive "cupelet" holds full factor weight for carbons.
- Small and compact—13" wide—28½" high—17" deep.

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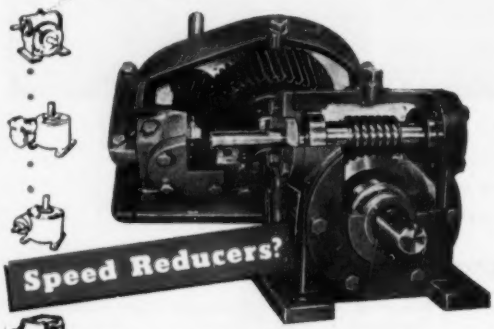

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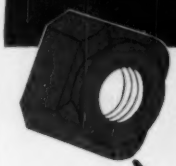
MIDLAND WELDING NUTS



SIMPLIFY attachment of metal parts

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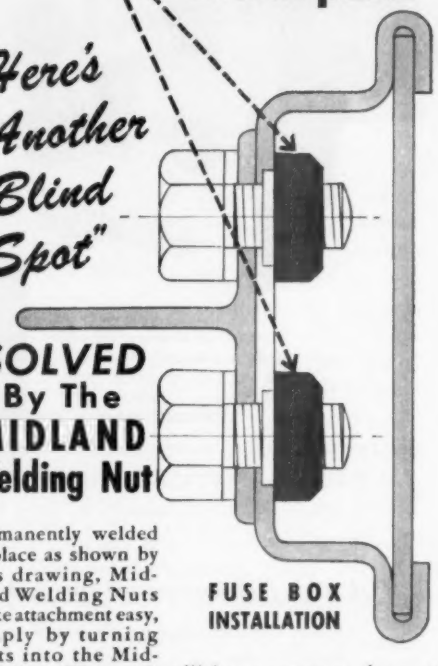

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Permanently welded in place as shown by this drawing, Midland Welding Nuts make attachment easy, simply by turning bolts into the Midland Nuts. The result will be as strong as the metal itself. Midland Welding Nuts stay put!

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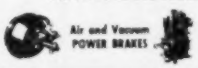

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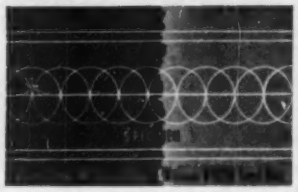

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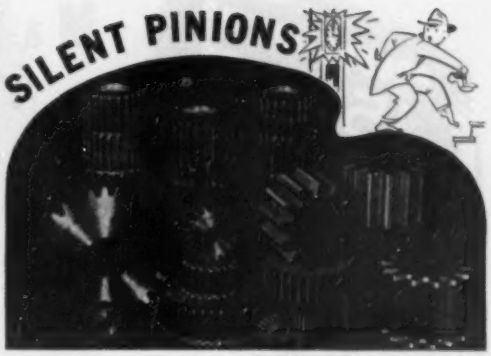

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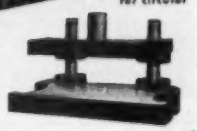

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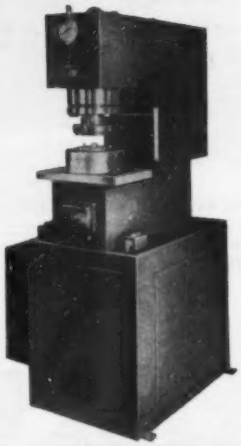

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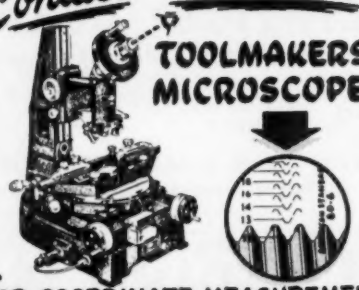

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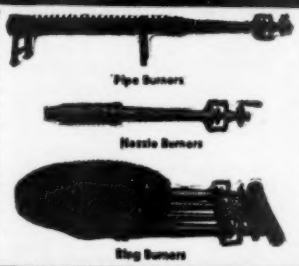

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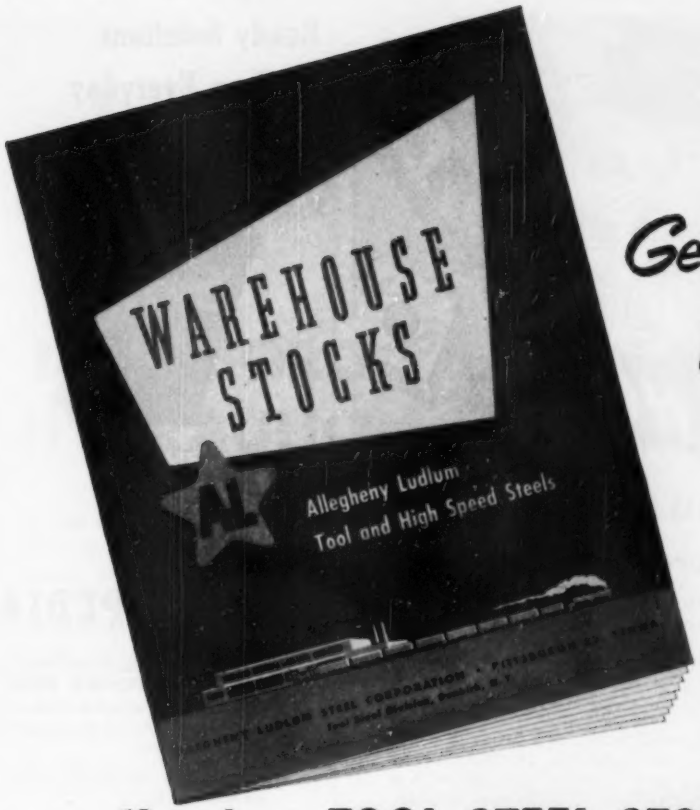

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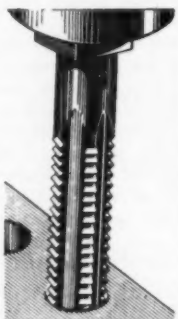

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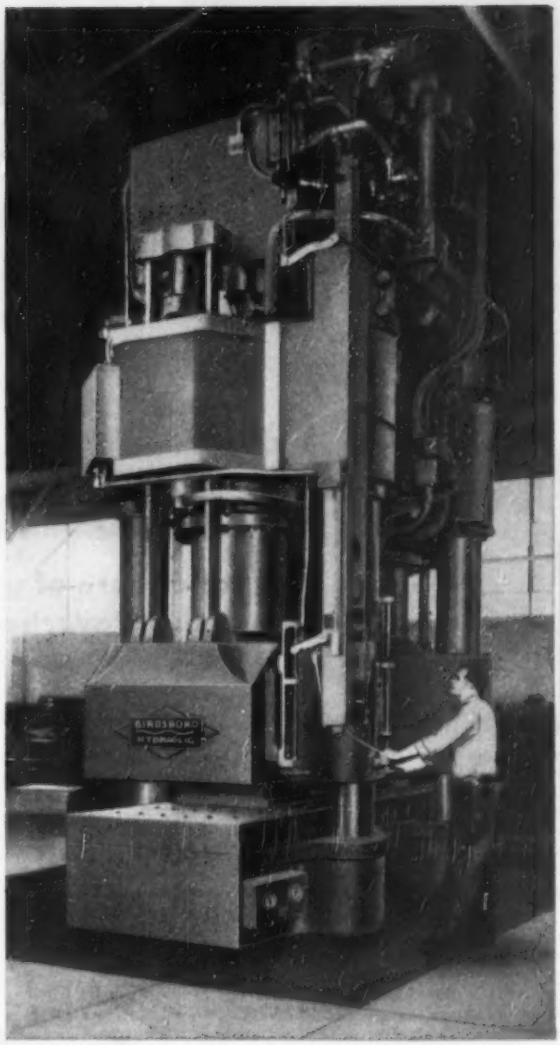
HP—4-50



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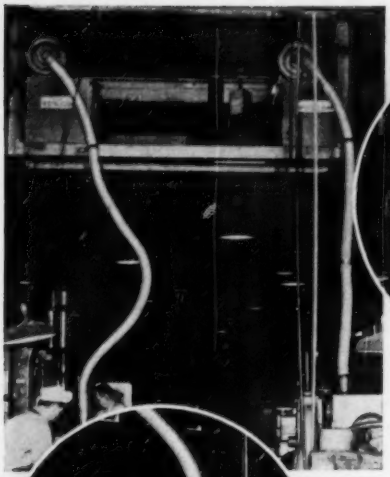

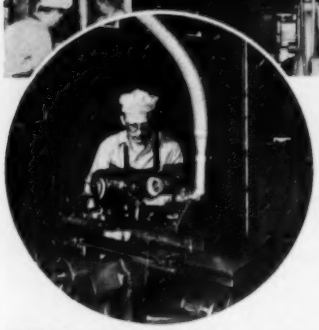

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takes care of grinder dust "overhead"

COSTLY "overhead" from grinder dust can be taken care of easily when a Roto-Clone* is installed. Pictured here are two of American Air Filter's Type D Roto-Clones, Self-Contained units, located overhead, away from machines, so valuable floor space is not sacrificed. Two different hood designs collect the dust—one from a shaft grinder, another from a surface grinder.

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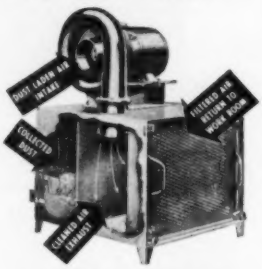
There's a clean saving with a Type D Roto-Clone—the Dynamic Precipitator orginated by AAF engineers. It can be installed as a central system or as an individual unit to serve a single dust-producing operation. If you are not using this method for dry collection of granular dust, then call a dust engineer for complete information, available through your nearby American Air Filter representative or write for Bulletin No. 275.



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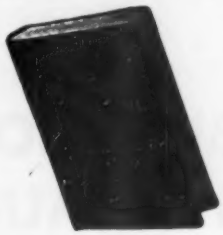

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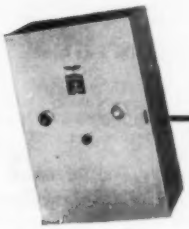

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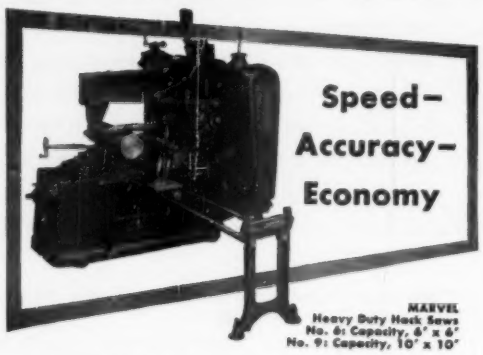

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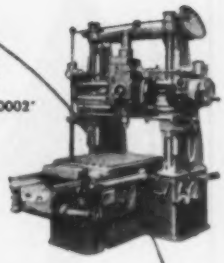

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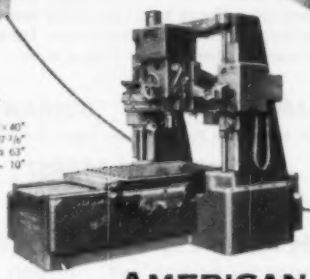

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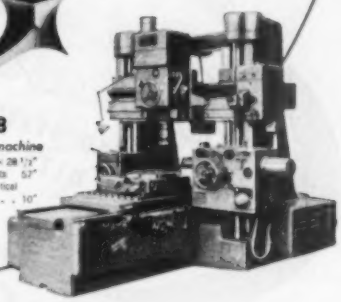

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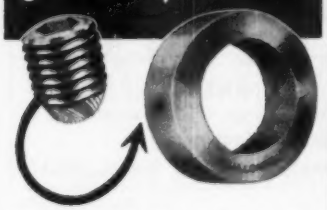

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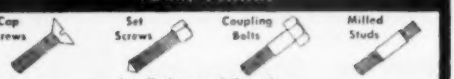

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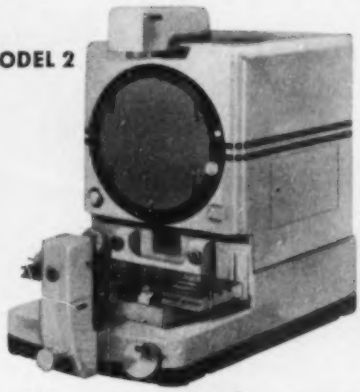

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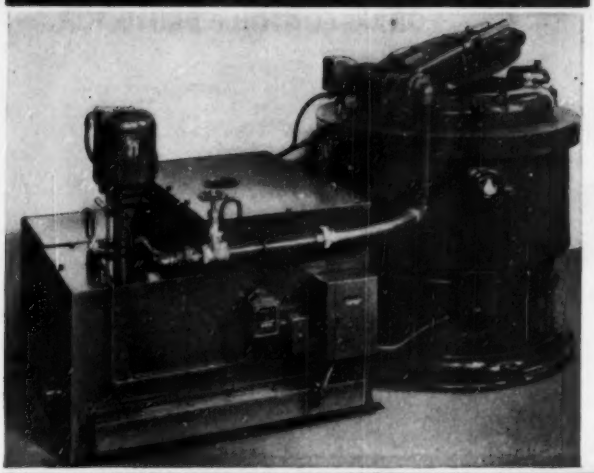

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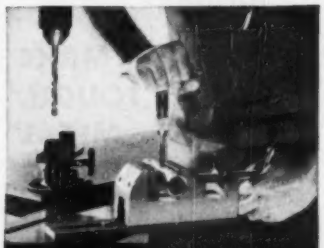
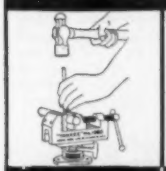


"Yankee" 1993 Vise, removed from swivel base and held by "Yankee" Vise Clamp for drilling and tapping.



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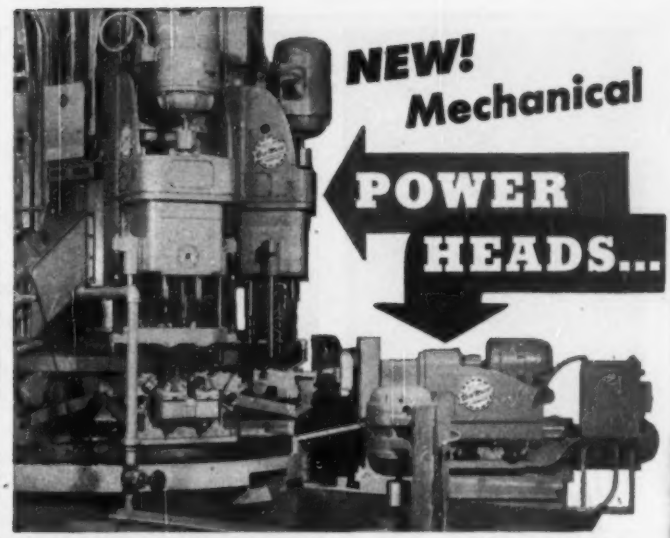

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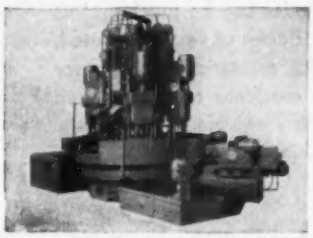

General view of drilling and reaming machine equipped with new Roto-Matic mechanical power heads.

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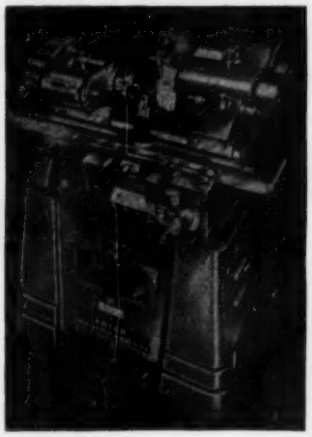

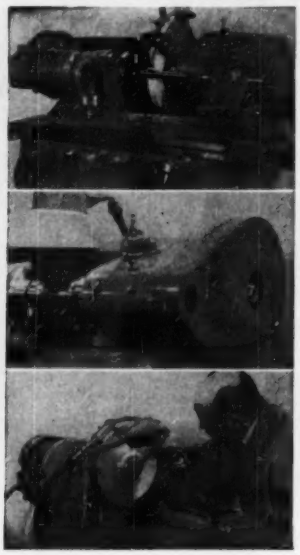

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WORCESTER, MASSACHUSETTS • U. S. A.

From The *American Machinist* Library of *Tips for Top Shop Men*

ASSURE your men that no layoffs will result from job improvements. Fear and insecurity are your greatest obstacles to employee cooperation on labor-saving devices.

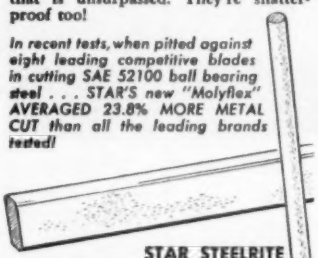
PREPARE the way for changes you contemplate. Show your men the benefits of the move. Keeping it under cover and springing it suddenly only arouse suspicion as to your motives.

NEW STAR molyflex blades

MAKE TOUGH, METAL CUTTING JOBS EASY

Here's the blade that will help you cut costs . . . speed up tough metal cutting jobs. These new "Molyflex" High Speed Hand Hack Saw Blades combine the ability to cut the hardest materials with a toughness and resistance to breakage that is unsurpassed. They're shatter-proof too!

In recent tests, when pitted against eight leading competitive blades in cutting SAE 52100 ball bearing steel . . . STAR'S new "Molyflex" AVERAGED 23.8% MORE METAL CUT than all the leading brands tested!



STAR STEELRITE METAL MARKING CRAYONS

Ask your STAR distributor about these new and improved metal marking crayons. Available in a variety of sizes, these crayons, made of genuine soapstone by special extrusion process, are uniform in strength and composition. Markings can be made on hot, cold, damp or grimy metal and withstand pickling, yet do not affect enamel application.

Get your free copy of STAR'S "Metal Cutting" Booklet and the STAR Wall Chart for your shop! Both are packed full of useful information and will help you get maximum results from band, hand and power hack saw blades.

CLEMSON BROS. INC.
MIDDLETOWN, NEW YORK
Manufacturers of Hand and Power Hack Saw Blades and Frames, Metal Cutting Band Saw Blades and Clemson Lawn Machines.

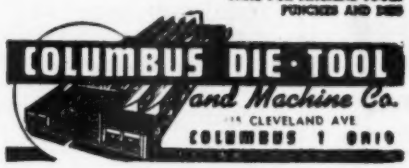
ACCURACY

Efficiency

Economy

These three factors are the key-note of our special tools and machinery. Columbus Die-Tool builds and designs the tool for your particular purpose and will solve the toughest tooling problems effectively and promptly. Do not hesitate to consult us, our experience in this field is most comprehensive.

JIGS • FIXTURES • SPECIAL TOOLS
BUILDING COMPLETE MACHINE TOOLS
UNITS FOR MACHINE TOOLS
PUNCHES AND DIES



COLUMBUS DIE-TOOL
and Machine Co.
CLEVELAND AVE
COLUMBUS 1 OHIO

"ROCKWELL"
HARDNESS TESTER
Made Only by Wilson

• Development and improvement of "ROCKWELL" Hardness Testers over the years have made "ROCKWELL" scales the universal standard of hardness. A reading on the "ROCKWELL," the "ROCKWELL" Superficial or the "TUKON" Tester is the same in any language.

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AN ASSOCIATE COMPANY OF AMERICAN CHAIN & CABLE

230-8 PARK AVENUE, NEW YORK 17, N. Y.

PUMPS IN COMPLIANCE
WITH J. I. C. STANDARDS

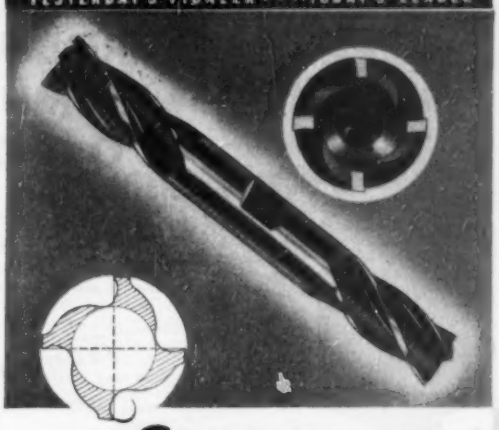
PIONEER Pumps

HIGH EFFICIENCY • LOW POWER CONSUMPTION
GREATER VOLUME AND LESS MAINTENANCE

FOR EVERY
INDUSTRIAL COOLANT AND
LUBRICANT APPLICATION

PIONEER PUMP & MANUFACTURING CO.
19651 John R Street • Detroit 3, Michigan

YESTERDAY'S PIONEER . . . TODAY'S LEADER



CHIPS CURL OUT INSTEAD OF CLOGGING with WELDON

CUPPED-END END MILLS

BETTER PERFORMANCE . . . LONGER TOOL LIFE

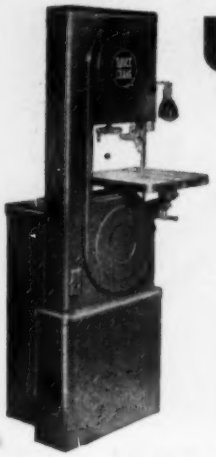
Over twenty-five years ago Weldon opened the door to higher speeds and faster feeds by developing a scientifically designed end mill tooth. This hollow ground tooth with its curved cutting face allows the chips to *curl* out without clogging. A further means to this purpose is the Weldon "cupped-end" which prevents chips from clogging the end teeth because it eliminates pockets which trap chips.

Another special feature originated by Weldon is the double back-off on the tooth, which gives greater support to the cutting edge, prolonging the life of the tool.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

THE WELDON TOOL CO. *Cleveland, Ohio*

3000 WOODHILL ROAD



UP PRODUCTION AS MUCH AS 1000%!!!

The New Boice-Crane Combination Contour Saw & Band Filer
CUTS — FILES — GRINDS

The first low-priced, compact, medium size, rugged and accurate combination contour saw and band filer.

PRODUCES

maintenance parts
short run production parts
metal templates
special wrenches
wrench templates
cams
spiral parts
irregular shaped stacked parts
stamping, forming, trimming dies
IN MINUTES, INSTEAD OF THE HOURS REQUIRED BY OLD METHODS INVOLVING MILLING, SHAPING AND HAND FILING.

PRECISION FILING, FILE BROACHING AND FLASH REMOVAL IN ONE-NINTH THE TIME

required by hand and *one-fourth* the time required by reciprocating filing machine. Eliminates guesswork in angle filing.

Rigid, solid welded steel frame. 15"x15" ribbed cast work table mounted on two heavy cast trunnions.

New guide design sharply reduces blade costs.

Handles blades 3/16" to ¾". File bands come in ¼" and ⅜" widths, two shapes, six cuts. Patented self-aligning ends of file segments automatically lock to produce a continuous, rigid, flat surface.

EXCLUSIVE!
8 speeds, from 92 to 4100 blade f.p.m.

Chart, mounted on machine, shows correct speed for accurate inside, outside and contour sawing of wood, sponge rubber, hard rubber, plastics, bakelite, masonite, asbestos, synthetic glass, transite, bronze, cast iron, bar and sheet steel, tool steel, brass, steel and aluminum tubing; and quickly converts for filing metals and other industrial materials.

USE COUPON TO GET FREE LITERATURE

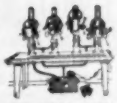
BOICE-CRANE COMPANY
935 Central Avenue • Toledo 6, Ohio

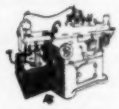
Please send free literature on the new Boice-Crane Combination Contour Saw-Band Filer.

Name _____
Firm _____
Street _____
City & State _____

Sold through industrial supply distributors in most cities

YOU ARE NOW READY FOR INCREASED PRODUCTION AT LOWER COST . . . PROLONGED TOOL LIFE . . . BETTER QUALITY WORK


FOR DRILL PRESS


FOR GRINDER

FOR LATHE

FOR CUTOFF MACHINE

Graymills Coolant Systems are made for 'round the clock operation . . . pumping coolants or heavy oils.

The above model G4-2-04, installed in 5 to 20 minutes, delivers enough coolant for a 6 to 8 spindle press. It is one of many complete Graymills Coolant Systems which will help you reduce tool costs, increase cutting speeds and improve quality.

RECOMMENDED AS REPLACEMENTS FOR MANY SMALLER COOLANT SYSTEMS WHICH ARE NOW BEING USED ON LARGER MACHINE TOOLS.

Used on all types of machine tools, the New Improved Graymills Coolant Systems are priced from $44.50. Gear and centrifugal pumps are 1/25 to ½ HP, 1 gal. to 70 g.p.m. Tanks 1 gal. to 38 gals. Fittings and recovery pans available.

*Model H-2-3325 $59.50

GRAY MILLS

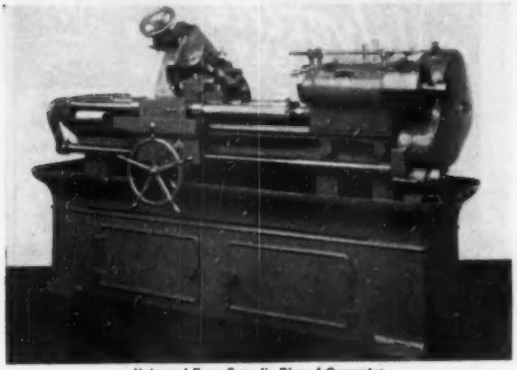
WRITE TODAY FOR NEW CATALOG AND ENGINEERING DATA DEPT. 2001

GRAYMILLS CORPORATION
Evanston, Ill.

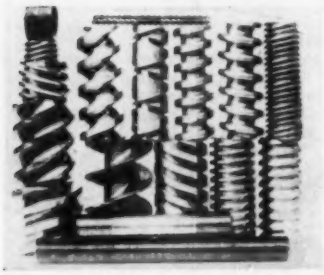
From the *American Machinist* Library of *Tips for Top Shop Men*

ARE you lugging materials to and from a machine for a minor operation that should be done where the material is? Check facing to length, centering, cut off, plain grinding. If volume is large, it may be cheaper to move the machine once and for all rather than moving the material continuously.

DON'T put a worried man on a critical job. If safety is a function of flawless timing, the man with something else on his mind is accident prone. Give him a safe job for a while, until his sorrow, illness, financial ailments, or mental scramble can straighten itself out.



Universal Type Cornelis Thread Generator



Cornelis circular cutter cutting worm thread, above, and some typical threads cut on Cornelis machines, at the left.

HIGHER CAPACITY PRECISION PRODUCTION

With the

CORNELIS THREAD GENERATOR

See this fully automatic threading and forming machine in operation at the First United States International Trade Fair in Chicago, anytime from August 7th to 19th, and judge it for yourself. You will be agreeably surprised at its ease of operation, its versatility and the elimination of costly indexing when cutting lead screws and worms of multiple thread.

The Cornelis Thread Generator, product of years' of experience, cuts threads by generating, as distinct from thread milling, lathe turning or die chasing. The Cornelis system is indispensable for accurately cutting lead screws and worms of multiple thread, because it requires no indexing. All thread starts are developed at the same time.

Two types of machine are available, a Plain for heavy duty work, and a Universal for normal production. The four bed lengths provided will handle threads up to 18, 37, 77 and 116 inches. Even longer screws can be cut on this *matchless* precision Thread Generator by simply resetting the work.

If you plan to be at the International Trade Fair it may be worth your while to see it in action on stainless steel valve stems. Leon J. Cornelis, of Maison Cornelis of Liege, Belgium, a noted thread cutting authority, will be on hand to demonstrate this equipment at its highest efficiency and to answer your questions.

If you won't be on hand, please drop us a line and we will send you complete engineering details on this machine by return mail.

GEORGE SCHERR CO. Inc.

200-D LAFAYETTE ST. NEW YORK 12, N. Y.

KEYSEATING The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY

403 EXCHANGE ST. ROCHESTER, N. Y.

Milmaster

PAYS FOR ITSELF IN A FEW DAYS!

YOU CAN convert a horizontal or vertical milling machine into a universal miller . . . with a MILMASTER. This rugged, precision tool *doubles* your machine capacity . . . slashes set-up time by as much as two-thirds.

MILMASTER is built by one of New England's oldest metal working specialists and is bringing completely new efficiency and economy in service the country over.

MAIL COUPON NOW FOR FULL INFORMATION

MILMASTER for horizontal and vertical milling machines.

BEMIS & CALL COMPANY, 215 Main St., Springfield, Mass.

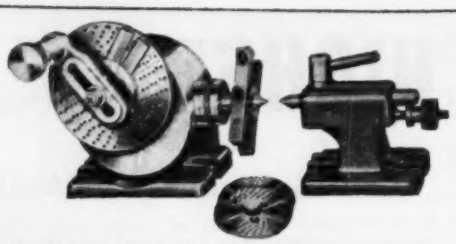
I am interested in more machine capacity. Please send me full details on the MILMASTER.

Name_____

Company_____

Address_____

City_____ Zone____ State_____



L-W Model SD 6½" Swing DIVIDING HEAD

Ideal for smaller Milling Machines. Spindle Threaded 1½"-8 to fit L-W 5" Universal Chuck.

- ACCURATE
- RUGGED
- 36 LB.
- QUALITY CONSTRUCTION

Only **$105.50**

Heavy duty headstock and tailstock designed for maximum rigidity. Alloy steel threaded headstock spindle with extra large tapered bearing and takeup adjustment collar. Head tilts to 90° in vertical position. Alloy stress-proof steel worm and accurately cut worm wheel cut to close limits for accuracy. Ball bearing thrust and adjustable for end play. Complete with three index plates for dividing all numbers to 50 and even numbers to 100, except 96T. Index chart shows all divisions obtainable to 380. Right or left hand models.

Model BP 11" Swing for plain milling machines. Shipping weight, 140 lbs. **$176.00**

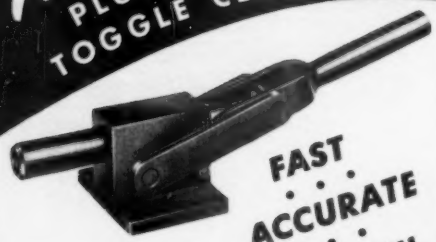
Model AU 11" Swing. Fully Universal for complete indexing and spiral cutting. Shipping weight, 190 lbs. **$254.75**

OUTSTANDING VALUES BY LARGEST BUILDERS OF DIVIDING HEADS

L-W CHUCK COMPANY 7550 ST. CLAIR ST. TOLEDO 4, OHIO

Wolverine PLUNGER TYPE TOGGLE CLAMP

SINCE 1926



MODEL C-130-A

FAST • • • ACCURATE • • • POWERFUL

The combination of a precision ground plunger and an accurately broached hole permits this clamp to be used for locating as well as heavy duty clamping.

IMMEDIATE DELIVERY
Write for catalog.

WOLVERINE TOOL CO.
1484 E. WOODBRIDGE
DETROIT 7, MICH.

From the *American Machinist* Library of *Tips for Top Shop Men*

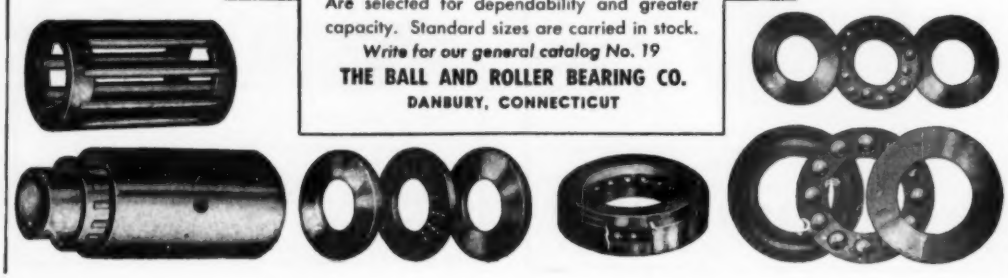
REMEMBER that old saying, "Trifles make perfection, but perfection is no trifle." Michelangelo said that 400 years ago, but it's still true. Unless you watch the little things, the big things will go wrong. Details take time, but you've got to be able to do them if necessary, and normally to see that they're done.

B & RB PRECISION BEARINGS

Are selected for dependability and greater capacity. Standard sizes are carried in stock.

Write for our general catalog No. 19

THE BALL AND ROLLER BEARING CO.
DANBURY, CONNECTICUT



How efficient is YOUR shop?

Over 42 per cent of metalworking production equipment is now over ten years of age . . . 19 per cent of it was bought more than 20 years ago!

This means that there is more over-age and obsolete production equipment operating in metalworking shops now than in 1945, and the rate of obsolescence is growing.

How about your shop? Are you equipped adequately with the modern, high-efficiency machinery and equipment which alone can produce the better products that cost *less to buy* which everybody wants? How does your shop compare with those of your competitors, and with metalworking shops generally?

You can find out quickly by writing for a copy of the *American Machinist* Mid-Century Inventory of Metalworking Production Equipment. Here are all the facts on the age and number of 155 major types of production equipment, operating in 15 manufacturing divisions and 25 major production areas. Price: $2.00 per copy.

American Machinist

Reader Service Department

McGRAW-HILL BUILDING
NEW YORK 18

All Standard Accessories Ready to Go Immediately
DETROIT DIE SET CORPORATION immediately on receipt of order ships all standard items in a wide range of sizes . . . dowel pins, die springs, stripper bolts, socket grip head cap screws and other accessories. All are nationally known products manufactured with the same precision as "DETROIT" die sets. For dependable shipment, 'phone, wire or write "DETROIT."
CALL "DETROIT"
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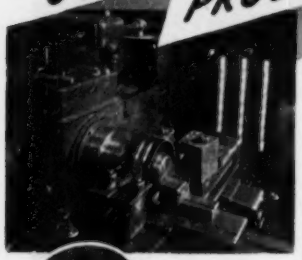
DETROIT DIE SET ★

From the *American Machinist* Library of *Tips for Top Shop Men*

BE careful neither to underestimate nor to overestimate the men you pick for promotion. A man may make an excellent *production* executive dealing with details and concrete things, but be out of his depth when he faces the intangibles of *administration*. He may be a whiz at watching the trees and no good at watching the forest.

AN essential to efficiency is regularity. The brilliant, but erratic—or the fast, but frequently absent—man will rarely show any efficiency. Remember the hare and the tortoise.

BIG MOTOR MANUFACTURER JUMPS PRODUCTION using ERICKSON Precision Expanding Mandrel



Using special Erickson face plate mandrel, drawbar type, with locators and positive drive pins, manufacturer turns outside diameter of motor stators and straddle faces; jumps production to 200 pieces per hour; preserves concentricity within very narrow tolerances. You'll probably be amazed at the almost countless applications to which Erickson Precision Expanding Mandrels can be adapted. Uniform vise-like grip throughout expansion range of 1/32", guaranteed accuracy of .0005".

Ask for Catalog "A-2" or Erickson Engineer

ERICKSON TOOLS

Division of Erickson Steel Co.

2302-D Hamilton Ave., Cleveland 14, Ohio

Investigate the Advantages of H & K PERFORATIONS

—for cleaning, grading, straining and filtering . . . guarding and ventilating . . . accoustical treatment . . . ornamental enclosure, and related problems of product and machine design.

You have a wide selection of patterns to choose from, all accurately perforated. For commercial processing, perforations may be had with as close tolerances as ± .0005" Materials include practically all metals and sheet materials such as plastics, fabrikoids, plywood, etc. Ornamental grilles are furnished in lightweight quality stainless, bronze, brass, aluminum, etc.

Perforated sheets may be furnished rolled, formed, sheared, welded, brazed or otherwise fabricated to your specifications.

Catalog No. 62 tells the "hole" story —write for it!

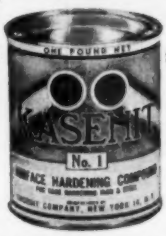
The Harrington & King Perforating Co.

5665 Fillmore St., Chicago 44, Ill.

114 Liberty St., New York 6, N. Y.

Here's the HARDENING COMPOUND you've been looking for

(ESTABLISHED 1912)



Reasonably Priced

Non-Poisonous

Non-Explosive

Non-Inflammable

A LITTLE GOES A LONG WAY

KASENIT has behind it a long record of success—in leading automotive, aviation, railroad and other metal-working shops all over the Country. Its regular users include manufacturers whose names are household words throughout industry.

You can depend on KASENIT to save you money and enable you to use less expensive steels. It is easy to use and can be effectively and economically applied to plain carbon and low alloy steels. It is an ideal hardening compound for gears, cams, shafts, collars, pins, nuts, bolts, small tools, etc. It is easy to control and will not scale or warp. Depth of hardening can be varied as required. The best way to prove these advantages for yourself and SAVE MONEY is to try KASENIT NOW!! Ask for prices.

Send TODAY for FREE SAMPLE—Use Coupon!

KASENIT COMPANY (Dept. AM.), 799 Greenwich St., N.Y. 14, N.Y.

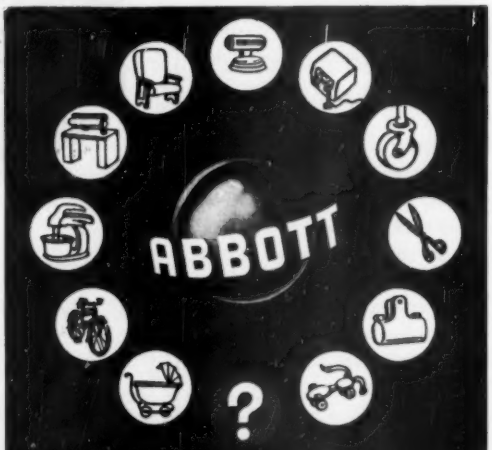
Gentlemen: Kindly send me a FREE SAMPLE of Kasenit Hardening Compound for trial.

Name .....

Position .....

Company .....

Address .....



EVERYWHERE *you'll find manufacturers using Abbott Balls for a variety of applications. If your product has an application for bearing balls, take advantage of Abbott's reputation for reliability and versatility. Write for catalog on Abbott . . . the all round ball.*

THE ABBOTT BALL COMPANY

5 Railroad Place, Hartford 10, Conn.

Give to Conquer CANCER

Strike Back!

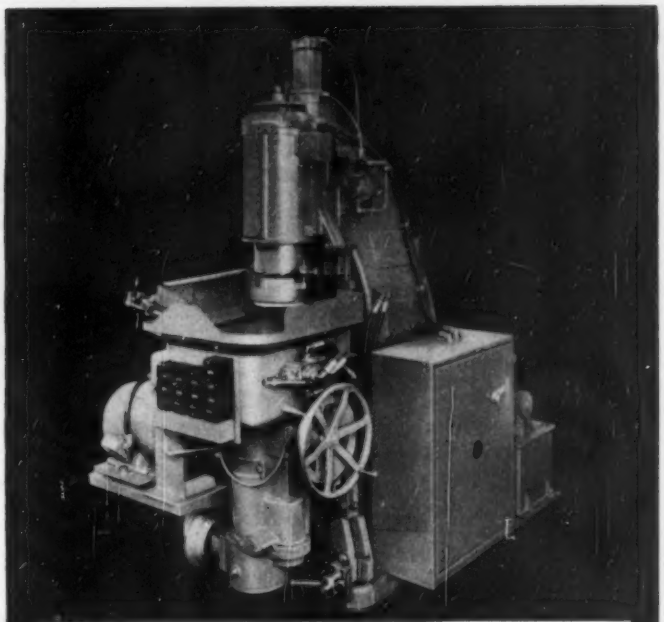
THE fight is on to save more lives in 1950! Now is the time to back science to the hilt in its all out battle against cancer.

Tremendous gains have already been made. Last year, 67,000 men, women and children were rescued from cancer. Many more can be saved—if *you* resolve to save them—if *you* strike back at cancer.

Give! Give your dimes and quarters and dollars. More treatment facilities are needed, more skilled physicians, more medical equipment and laboratories. The success of great research and educational programs depends on your support.

Your contribution to the American Cancer Society supports these vital efforts. It helps guard your neighbor, yourself, your loved ones. So this year, strike back at cancer . . . Give more than before . . . Give as generously as you can.

American Cancer Society



Walker High Production Vertical Stroke Grinder — the only Grinder of its kind and does not compete with other Grinders.

Specially designed primarily for the Saw, Circular Tool and Glass Industry.

Can grind *flats* — *convex* — *concave* and *bevels* to 15 degrees.

Has clearance for 8" hubs and can grind to a combination of radii giving a parabolic curvature.

Electric controlled — hydraulic feed — rapid traverse.

O. S. WALKER CO. Inc.

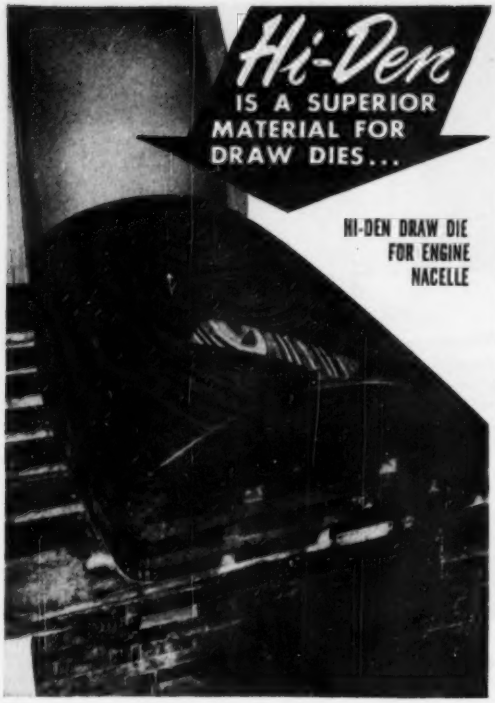
WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

From the *American Machinist* Library of *Tips for Top Shop Men*

PRE-EMPLOYMENT testing not only doesn't solve all personal problems—it may intensify them. When you sart with good workers, you must work extra-hard to keep them good and to get the *most* from their potentialities.

CHALLENGE your own preferences. Do you prefer air over electricity, bolting over welding, milling over shaping? Each should be used in its proper place, not ticketed as a pet or a pariah.



NOW . . . make your DIES of Hi-Den and save 83% of fabricating cost!

You can use standard tools of tungsten carbide or even high speed steel to shape your drawing dies—large or small.

Hi-DEN, made from selected wood veneers impregnated with phenolic resin (laminated and compressed at extremely high pressures), is **far stronger than equal weight in steel!** It has been successfully used for nearly 10 years in the aircraft and other metal working industries for dies, jigs, pressure pads, spinning chucks, etc.

Amazing savings are being made with Hi-Den in some of the country's largest plants. An aircraft manufacturer* found over 100 different applications for it; a bus manufacturer* used Hi-Den for forming and draw dies, got a **50% greater depth of draw than** when using a steel die, never had a breakdown or replacement in a 3-year period, and some dies produced **more than 8,000 parts!**

Hi-Den is stronger, has a low coefficient of friction, is superior in drawing sheet metals, is lighter in weight and easier to handle, has dimensional stability and is **extremely versatile.**

INVESTIGATE THIS REMARKABLE NEW MATERIAL!

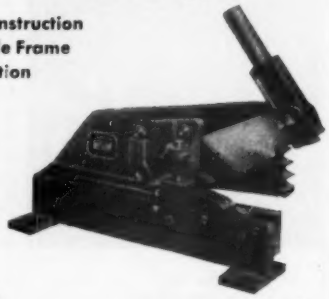
Send today for technical bulletin "HOW TO USE Hi-Den" to improve quality while reducing costs.

*Name on request.

Parkwood Corporation
28 Water St., Wakefield, Massachusetts

New SAMSON HAND SHEARS
Bench Type

- All Steel Construction
- Unbreakable Frame
- Easy Operation



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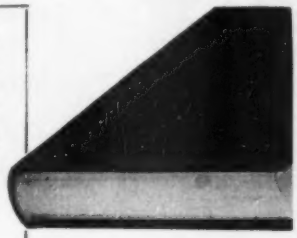

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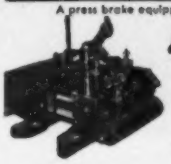

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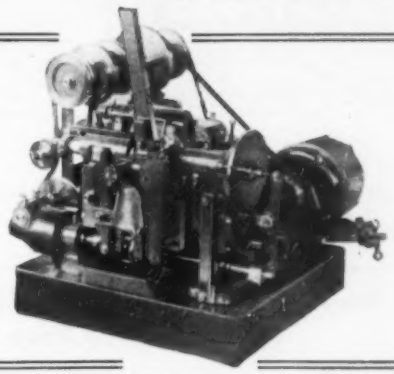

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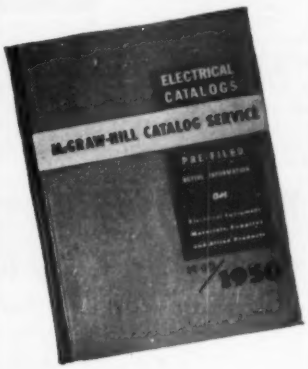

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BULLARD 24", 36", 42" Vert. Turret "Spiral Drive" High Speed, Latest Type
COLBURN 72", 2 swivel heads, PRT, M.D.
NILES 100", 2 swivel heads, Rapid Traverse, AC M.D.

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LELAND & GIFFORD #1LMS, 4 Spindle, Latest Type
LELAND & GIFFORD—#2, #2MS Single Spdle
LELAND & GIFFORD #2 LMS 6 spindle, Latest
NATCO #4AL Multiple, 30 spindles, Hyd, Latest Type

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CROSS #1 Tooth Rounding Machine, Motor Drive
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High Speed Gear, Shaper, Latest Type
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BROWN & SHARPE #5 Plain, 2 x 12, Latest Type
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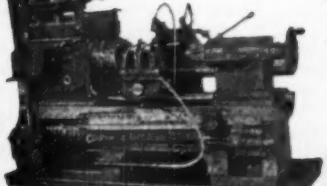
HEALD 72A3, 72A5, Internal, latest type
HEALD #81 Internal Sizematic, Latest Type
HEALD #81 Internal, Centerless, Sizematic and Gagematic, Latest Type
KEARNEY & TRECKER Face Mill Grinder, Latest
LANDIS #6, 6x24 Thread, latest type
La PONTE 60" Universal Broach Sharpener, Latest
THOMPSON 6"x48" Auto. round broach M.D.
VAN NORMAN #639, #73 Disc, Radius Grinder, Latest
VAN NORMAN #606 Crankshaft ReGrinder, Latest



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HALL, Style L, Planetary, latest type
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INGERSOLL 32x24x18' Planer Type 2 heads, M.D.
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SUNDSTRAND Model 3A Duplex 42" feed, Latest
TAYLOR & FENN M80 Duplex Spline, latest

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BROWN & SHARPE #000, Timken, Latest Type
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MOREY 12x30", 08", 12x60" Model C, Latest Type
PRATT & WHITNEY 4"x12" Model C, Latest Type
PRATT & WHITNEY #200 Model C, Latest Type

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CINCINNATI #2, Dial Type, High Speed, Latest
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MOREY 12M Single & Double Spindle Profiler, Latest
REED PRENTICE 3VG, with or without hydraulic duplicator, Timken bearing, Latest Type

PLANERS

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BETTS (CONSOLIDATED) 108"x84"x36' 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
CINCINNATI 26"x96"x48", 4 heads, PRT, DC, M.D.
CLEVELAND 48"x48"x12' Openside, Motor Drive
DETRICK & HARVEY 48"x48"x16' 4 heads, Hydraulic Rapid Traverse, A.C. Motor Drive
NILES 108"x84"x42" 4 heads, Box Table, Rapid Traverse, D.C., M.D., Late Type
NILES 48"x48"x12" "Time Saver" Box Table, 3 heads, D.C. reversing motor, Latest Type

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For MODERN high quality machine tools nearly all built new since 1941. These tools are priced well within your equipment budget. Wire, write or phone for pictures, details and prices, today.

NILES 42"x42"x14' "Time Saver" Box Table, 2 Heads, PRT, VARI-VOLTAGE Drive, Latest
NILES 96"x96"x24' 4 heads, Rapid Traverse, Box Table, D.C. reversing motor drive

PRESSES

BIRDSBORO 325 ton, vert. hyd., Latest Type
BLISS 75-35 Hydro-Dynamic, Double Action, Latest
CLEARING K-1200-30 Knuckle Joint, 200 ton, 4" stroke, Latest Type
GLEASON 15" Quenching, Hyd., Motor Drive
LAKE ERIE 500 ton Vert. Hyd., Latest Type
TOLEDO #93A, 88 ton geared, Motor Drive
NIAGARA #56B, 88 ton geared, Motor Drive

SCREW MACHINES—Automatic

CLEVELAND 9/16", 1-1/16" Model A, Latest Type
CONOMATIC 3½" 6 spindle High Speed, latest type
GOSS & DeLEEUW 6" 5 spindle Chucker, Work slotting, Latest Type

SHAPERS & SLOTTERS

AMERICAN 20" Heavy Duty, Motor Drive
CINCINNATI 20" High Speed, Latest Type
DILL 24"-24" Vertical, Motor Drive
LAMAIRE 18" Vertical, Hydraulic, Latest Type

SHEARS—Power

QUICKWORK #5, ¾" Cap. Rotary Shear, M.D.
QUICKWORK #6, 1" Cap., Rotary Shear, M.D.
WYSONG & MILES #572, 14 gauge x 6' Latest Type

MISCELLANEOUS

AJAX 3½" Forging and Upsetting, M.D.
BAKER #5 Kerosene Motor Drive
BARNES #17, 306H, 307, 307B Vertical Hone, Hyd.,
CAMPBELL, #401 Abrasive Saw, Latest Type
DE LAVAL #194 Coolant Clarifier, Latest
FOSTER 4"x16", 4"x36" Superfinisher, Latest
HELLER Model 8S-1 Cold Saw, 6" cap., M.D.
LANDIS 2 Single Spdle. Bolt Threader, M.D.
NATIONAL 4" Forging and Upsetting, Latest type
NAZEL #4B Pneumatic Hammer, M.D.
PEERLESS 14"x14" Hydraulic Hack Saw
PRATT & WHITNEY (KELLER) Type BL-2416, Type G. Copying 2 and 3 dimensional, Latest Type
ROWBOTTOM Cam Miller, Motor Drive
STURDIBENDER 5/16"x6' Power Press Brake, Latest

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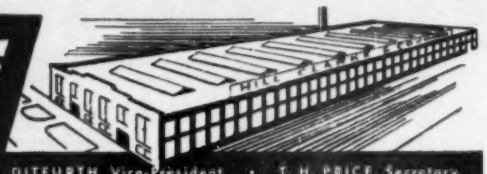

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AUTOMATICS
No. 40 New Britain, 4 Spdl. Chucker
Model A 3¼" Cleveland (1942)

DRILLS
No. D6 Colburn, No. 6 Morse Taper
No. 206—26" Defiance #5 Taper (1943)
No. 4—B Edlund S.S. No. 3 Taper
No. 1-LMS Leland-Gifford (1942)
No. 2-LMS Leland-Gifford (1942)
No. 4BL Natco 36 Spdl. (1943)
3'-10" American Triple Purpose, M.D.
3'-10" Fosdick
5' Western Heavy (1942)
6'-17" Fosdick Hyd. Economax Radial

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
No. 16 HS Gould & Eberhardt
No. 12 Gleason Bevel Gear Generator
72" Cincinnati Gear Cutter
No. 3 Barber-Colman Hob Sharpener

BORING MACHINES
No. 31 Lucas 3" bar, M.D.
No. 32 Giddings & Lewis, 3½" Bar
No. 2 Lambert 4" bar
No. 46-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
24" Bullard
42" Bullard New Era
60" Colburn, M.D.
72" Niles-Bement-Pond
84" Betts, M.D.

GRINDERS
3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
4"x18" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
10"x96" Landis Type C hydraulic (1942)
Norton Motorized Grinders ranging from 6"x18" to 18"x96"
No. 3 Abrasive Surface Gdr.
No. 34 Abrasive Surface Grinder (1943)
No. 11-16 Blanchard
No. 72-A-3 Heald Internal (1942)
No. 72-A-5 Heald Internal (1942)
No. 18—36 Bryant Internal Gdr.

LATHES
18"x6' American, Gdr. Head, M.D.
18"x8' American Gd. Hd.
24"-27"x22' Lodge & Shipley
36"x18' Betts—Bridgeford Grd. Head
36"—48"x16' Lehman Hydratrol (1945)
8"x15" Sundstrand, Model B (1943)
10"x22" Sundstrand, Model AA (1943)
20" Fay Automatics (1942)
Model R-14 Seneca Falls Lo-Swing
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4R Libby, Bar Feed (1942)
No. 5 Bardons & Oliver (1942)
No. 2-A Warner & Swasey (1941)
No. 1-H Libby, Extra Long Bed (1942)

MILLING MACHINES
No. 3B Milwaukee Plain
No. 5 Cincinnati H.P. Plain
No. 3 Cincinnati Univ. motor-in-case
No. 3 Cincinnati Universal
No. 2M Cincinnati Vert. (1941)
No. 2 Cincinnati Dial Type Vertical (1941)
No. 2 Cincinnati Vertical
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cincinnati Mfg. (1942)
No. 2—18" Cincinnati Rise & Fall (1941)
No. 2—18" Sundstrand-Electromil (1942)
No. 3-24 Cincinnati Hydromatic (1942)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 45-48 Cin. Hyd. Tracer (1941)
No. 56-72 Cincinnati Hydromatic
No. 56-90 Cincinnati Hydromatic
4½"x12" Pratt & Whit., Model C Thread Mill
6"x36" Lees-Bradner—Model LT (1943)
10"x48" Hanson-Whitney Thread (1942)
12"x24" H.T. Lees-Bradner (1942)
24"x24"x12' Ingersoll Adj. Rail Slab Miller
36"x24"x12' Ingersoll Duplex Miller (1946)
No. 10 Ingersoll 72"x6' Travelling Col. Face Millers (1942)
No. 28-60 Cincinnati Hydrotel

MISCELLANEOUS
18" Dill Slotter
Micromatic Vertical & Horizontal Hydrohoners

PLANERS
36"x36"x12' Cincinnati
36"x36"x18' Gray Maxi Service, 4 Heads
48"x36"x14' Gray
48"x48"x12' Cincinnati, 4 Heads
144"x76"x48' Liberty Openside Planer

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MILLING MACHINES
#2 Cincinnati High Speed Dial Type Universal, div. hds.
Type "P" Ohio Production, 36" table travel
#2-18 Cincinnati Automatic "Rise & Fall"
#0-8 Cincinnati Vertical
#2RV Kent-Owens Hand, variable speed drive

TURRET LATHES
#4 Warner & Swasey "Preselector", air chuck
#3 Gisholt Universal, chucking work
#601-DD Oster "Rapiduction", bar feed

MISCELLANEOUS
10"x24" Landis Type "C" Hydraulic Univ. Grinder
#35-L Ex-Cell-O Precision Thread Grinder
6"x36" Model LT Lees-Bradner Thread Miller
16"x21" Fay Automatic Lathe
A-3 16" Arter Rotary Surface Grinder, rectifier

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BARBER COLMAN Type "T" Taper Spline Gear Hobber

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PEXTO & WILCOX 52"x10 Gauge Power Squaring Shear

CINCINNATI-GILBERT 4'x11" Column Radial Drill with 2 Side Bases and Universal Box Table

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7½ Ton Northern. Span 31'4". AC 220/3/60. Floor control.

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Used & Guaranteed West.—AC Transformer Type.
WT4 200 AMP., Portable, 220 Volts—$95.00.
WC2, 300 AMP., Portable, 220 Volts—$155.00.
Also new G.E. 150 AMP. Atomic Hydrogen Arc Welder with Transformer and Auto. Head—$650.00.

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Specialists in Sheet Metal Machinery
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AIR COMPRESSOR
Ingersoll-Rand Type ES-1 Air Compressor, (1942) 1,000 Cu. Ft. per min. at 20 lbs. discharge. Complete with 75 HP Westinghouse Motor.
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AUTOMATICS
Brown & Sharpe, No. 00G.
Cone 4 Sp. 1½" Autos.
Fay Automatic, 12"x81".

BORING MILLS
Giddings & Lewis No. 0, No. 25T.
Lucas No. 31, horiz.
Heald #49 double spindle, #48A
Universal 3" horiz. equipped.
Bullard 24", 36", 42" VTL
King 72", 42" vertical

DRILLS AND RADIALS
Barnes No. 242, No. 5 Morse
Carlton 8'-19" column
Canedy-Otto 3'-9" col.
NATCO No. B25H multi-spindle
Cincl-Bickford 21" Box Col. S. S.
Sibley 24"-28", Power Feeds
Hamilton, Langelier, Hi-Speed.

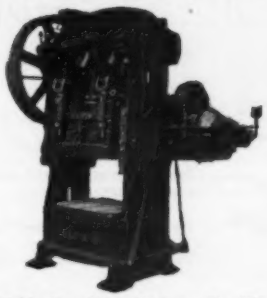
ENGRAVERS
Gorton No. 3U & 3L
Deckel GIL, 2 dimen.
Gorton Cutter Grinders 375-2, 265-6.

GEAR EQUIPMENT
Barber Colman No. 3 Precision
Fellows #7, 72, 712, 725, 7125, High Speed.
Fellows 646Y Spur & Spiral
Gleason #2 Surface Hardener.
Gleason 8" Spur Bevel Generator
Hamilton Hobber #00
Michigan, Gleason, Fellows Checkers.
Mikron Gear Hobber.

GRINDERS, MISCELANEOUS
Brown & Sharpe No. 5 cyl. 3" x 18", 8" x 12".
B. & S. Nos. 1, 2, 3 Univ.
B. & S. No. 13 Univ. & Tool.
Bryant #16 Internal
Cinn. 12 x 48" Filmatic Univ.
Cinn. #2 Univ. Tool & Cutter
Covel No. 91A Univ. T. & C.
Dalzen Thread, latest
Gardner #226, 30" Disc.
Hanchett #228 Disc. Dbl. opposed w. M.D. Feed.
Heald 72A3 Sizematic Int. Centerless, 81 Internal.
K.O. Lee Tool & Cutter.
Landis, 10x24" type C Univ. No. 6 Thread, 10 x 36" angu.
Norton No. 2 Tool & Cutter, Hyd.
Oliver 510 Drill Grinder, Sellers 4G Drill Grinder

GRINDERS, SURFACE
Abrasive #3B, 8"x24" cap.
Abrasive No. 33, 34 Vert. 8x24.
Blanchard No. 11, 16" Mag. Chuck.
Blanchard #16A—30" Chuck
Blanchard #18-30" Chuck
G & L Hyd. #25, 6x18", #35, 8x24", #45, 12x24".
Hanchett Model 300, 13 x 48".
Heald #25A Rot. Surf 16" hyd.
Norton 6x18", and 10x36" Hyd.
Reid No. 2A P.F. MIB.
Reid No. 2C Motor Spdl. Hand Feed.
Thompson Hyd. 6 x 10 x 18", 6 x 12 x 18"

LATHES
Bradford 14"x6', G.H. Latest Sebastion 12"x4'
Hardinge Precision, 1" Collet Cap., Rivett. Precision.
Hendey 12" x 42" GH.



Bliss Double Crank Toggle Press No. 406—48"

Bliss #3½A Toggle Press Geared.
Bliss No. 304A, 306 Straight Side Presses.
Bliss 645B, 650 High Production Presses.
Henry & Wright 25 and 75 Ton Dieing Presses.

HYDRAULIC PRESSES

DOWN MOVING RAM, SELF CONTAINED

MANUFACTURER	TON CAP.	STR.	OPENING	PLATEN
Lake Erie	500	36"	68½"	35 x 36
H.P.M. Double Action	500	24"	30"	36 x 36
Watson Stillman Shaft Straightener	500	24"	57"	24' bed.
Denison	25/50	18"	23"	22 x 20
Hannifin	50	20"	30"	22 x 30
Southwark, D. A. Clamping Plate	125	30"	2' to 4'	84 x 30
Oilgear Shaft Straightener	35	8"	12"	84 x 11

DOWN MOVING RAM, WITHOUT POWER UNIT

Mesta	750	42"	88"	44 x 44
Chambersburg	300	10"	27"	22 x 36
Southwark	350	42"	78"	28 x 48
Southwark	550	23"	46½"	42 x 32

UP MOVING RAM PRESSES

Watson Stillman	100	8"	11½"	18 x 18
Southwark	600	20"	27" to 48"	34 x 24
Waterbury Farrel	800	6½"	28"	22 x 24
Birdsboro	800	20"	30" to 48"	40 x 32
Watson Stillman	300	12"	21"	24 x 20
Watson Stillman	300	12"	19"	20 x 20
HPM	180	15"	14½"	16 x 30
Dunning & Boschert Molding Press	300	12"	38"	24 x 32 Mold
Stokes Molding Press and Pump	50	7"	24"	20 x 12
Stokes Molding Press and Pump	150	8"	31"	24 x 23
Elmes—With Elec. Plates	50	6"	12"	18 x 18
Stewart Boling	85	10"	19"	20 x 20

WHEEL PRESSES

NILES — 600 ton 96" 500 ton — 48"; 300 ton — 48.

INJECTION MOLDERS

ACCUMULATORS

Mfr.	Size	Pounds
HPM	6" x 9'	2000
General Electric	15" x 11'	400
Watson Stillman (13 gal) Hydr. Pass.	42 x 9 x 48"	3000

Hendey G.H. 16x30", Rel. Att.
LeBlond Regal 10"x31½", 13"x24", 15"x30", 16"x48" T.A. 19"x48", T.A. 21"x60"
LeBlond Heavy duty 16"x30".
Lodge & Shipley 16 x 78" T.A., Collets, etc.
Lodge & Shipley 20"x54" G.H. 24 Spindle Speed latest
Monarch 10"x20" EE.
Monarch 12x30" Dble. Compound, swings 18", 12"x30" CKK
Rivett 608 QCG, TA
South Bend Q.C.G., 13"x6', 16"x4'

MILLS, PRODUCTION
Brown & Sharpe, No. 000, 12, 21.
Cincinnati No. 1-18, 2-18, Mfg., 50-96 hydromatic
U. S. Multimiller, 1 & 2 Spindles.
Sundstrand 00 Rigidmills, Kent Owens IV.

MILLS, PLAIN AND UNIVERSAL
B. & S. No. 2B PL, No. 2A Univ.
Cincinnati No. 3 Plain, 2M Plain
Cincinnati No. 2MH Univ., H.S.
Milwaukee 2HL, 2H Univ., H.S.
Milwaukee No. 2H Plain, HL
Van Norman Duplex, 6, 20, 22L, 36.

MILLS, VERTICAL
Index, Jackson
Brown & Sharpe No. 2 Standard.
Cincinnati No. 4, Hi-Power.
Gorton No. 8D, 9-J Plain.
Morey No. 12M Profiler 2 sp.
Sipp MP5 Jig Borer
Fosdick #30 & 42A Jig Borers.
Pratt & Whitney #22 Jig Borer

PRESSES
Bliss No. 18, 19, 20, 21, OBI.
Bliss No. 304A, 4" Str. 22"x24" bed, #306 w. Air Cushion. S.S.
Bliss No. 645B, 650 Hi-Production, 58, 62, 62A, 162.
Bliss No. 4½ Double Action Cam Gen. flexible Screw Press.
Henry & Wright Dieing, 25, 75 Ton.
L & J #2, O.B.I. & V & O #01
Reliance 45 Ton, O.B.I.
Z. & H. 30 Ton, O.B.I.
Stoken Tablet Presses, Model R & T, DD2, & Colton Tablet Presses

TURRET LATHES
Acme No. 4W, 6 W Bar and Chuck, Acme Fox.
Bardons & Oliver No. 3, 1½" cap., No. 5, Chuck.
Brown & Sharpe No. 1, 2F
Foster No. 3B.
Gisholt No. 4, 5 Bar and Chuck, 2L, Saddle Type
Jones & Lamson #5 Univ. Preselector head.
Warner & Swasey No. 2, 4, 5, Preselector, No. 4A 8" Cap.

MISCELANEOUS
Band Saw: Tannewitz No. 36M.
Broach: American Horiz. Hyd. H-15-60.
Comparator: J & L 14" pedestal
Hacksaw: Marvel Nos. 6 and 6A, 9A Automatic Feed.
Marking Machine: Noble & Westbrook
Notching Press: Ferracute C82.
Pin Machine: Nilson.
Shaper: 24" Rockford Hyd. Heavy Duty.
Cinn. 24" Universal.
Sheldon 12" Brand New.
Honer: Micromatic Hydrohoner, Sunnen.
Keyseaters: Mitts & Merrill, Baker, Burr, Davis.
Rivet Hammers: Hi Speed.
Toolmakers Microscope: Gaertner, Bausch & Lomb, Leits
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Haskins No. 3C, 3CAM.
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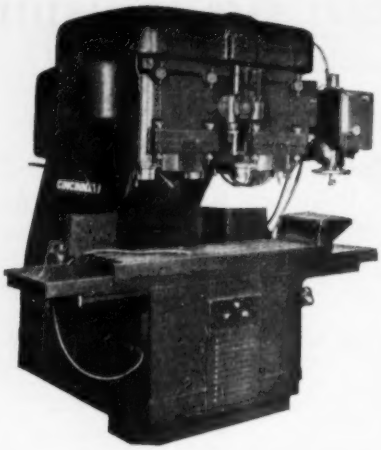

CINCINNATI 4-SPINDLE 360° AUTOMATIC PROFILING MACHINE

Table working surface 14"x47¾"
Longitudinal travel of table 12"
Transverse travel of cross-slide 15"
Vertical travel of head 6"
Spindle center distance, center to center 12"
No. 40 National Standard Taper
Diameter of spindle nose 3½"
Diameter of hole through spindle ¾"
Speeds 20, 125 to 3800 RPM
Feeds—Infinite range 1" to 50" per min.
Complete with motors, pumps, piping and all electrical controls. Weight approx. 10,300 lbs.

JUST RECEIVED!!!

12"x102 Lees Bradner, model HT, 6" hole through spindle. 3-jaw universal chuck at each end of spindle. Latest
14"x72" Cincinnati Uni Grinder, latest
54" Bullard Vertical Turret Lathe, spiral drive, threading attachment

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No. 14 Buffalo Steel Billet Shear, 5½" round capacity.
No. 10 Buffalo Steel Bar Cutter, 3½" round capacity.
No. 60 Cameron Rotary Cap Thread, Roller, M.D.
No. 3Z Gorton Pantograph Engraving Machine with roll die att.
12"x12" Type DA Dings Magnetic Chip Separator.
No. 40-5 Minster S.S.—D.B.G. Press, 16" stroke.
No. 4 LaPointe Broach, 50 ton capacity.
50 Ton Henry & Wright Dieing Machine.
10"x18" Cincinnati Model EA Grinder, serial #5P2A1L-13.
No. 5-60 Cincinnati Hydromatic Production Mill.
2HL Kearney & Trecker Universal Mill (1945)
No. 5 Loshbough Jordan B.G.—O.B.I. Punch Press, M.D., 4½" stroke.
1½" Conomatic Automatic Screw Machines, late. (3)
No. 61 New Britain Automatic Screw Machine, serial 26,000
No. 2G Brown & Sharpe H.S. Aut. Screw Machine, serial #10815, 1½" cap.
8½"x8" Goss & deLeeuw Automatic Chucking Machine.
20" Ohio Shaper (1943)

MACHINE TOOLS

TELEPHONE TAylor 9-8200
LAKE MACHINERY COMPANY
942 WEST LAKE STREET • CHICAGO 7, ILLINOIS

LATHE — Engleo, Mackintosh-Hemphill 72"/110"x30' centers (1943)
HYDROTEL — Cinc. Vert. Mill #28/60, 4 spindles, tracer (1942)
SQ. SHEAR—Cinc. 6'x½" All gauges (1944 Like New).

BORING MILLS—D & H 3½" horiz., floor (Bargain) Bullard V.T.L. 24", side head, Serial #11,165
DRILL PRESS—Minster #2D, heavy duty, 2½" cap.
GEAR GENERATOR—Gleason #12, cap. 18" (1942)
HONER—Micromatic Hydro. Model H-4.
MILLERS—Cinci. #3 Plain horiz. Hi Power (Bargain)
Cinci. #3 Vertical Hi Power (Bargain).
Newton Vertical 24"x42" rotary (Rebuilt)
PLANERS—N.B.P. 48"x48"x26'—4 Heads
Hamilton 36"x36"x10'—3 Heads, closed
ROLLS—BENDING—H. & J. 30'x¾", Pyr. Southwark 15'x3", Pyr., Vertical
Angle-Bertsch, 3"x3"x¾", Initial
ROLL GRINDER—30"x15' centers, crown attach.
SHAPER—G. & E. 24", back geared (Bargain).
SHEAR—Alligator (#2) 24" Blade, 3" Rds., etc.
THREAD MILL—Morse 12"x10' centers (1942)
PRESSES—Bliss #20—30 ton OBI, Adriance #4—40 ton OBI
Z & H #7—50 ton Percussion
Bliss #5—125 ton (1942), Bliss #78½—450 ton 18" stroke
HYD. PRESS—375, 500, 675, 750, 3000 ton

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No. 2G B & S Automatic, S.P.D.
No. 1 W & S Elect. Head Turret Lathe.
Nichols No. 5C Hand Mill.
Hanna 80-ton pneu. Yoke Riveter.

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1—Monarch Engine Lathe, 16" swing, 48" bed.
1—3A Warner-Swasey Turret Lathe.
1—Greenard Hydraulic Press, 10 ton. Like new.
Aluminum patterns for V-belt Sheaves, 1 to 4 grooves, 3.0 to 18.4 and miscellaneous B and C patterns.
1—500 pound Campbell-Hausfeld Tilting Aluminum Furnace. Brand new, never used.

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AUTOMATIC SCREW MACHINE, #00 Brown & Sharpe, Cap. 5/16", Slotting Attachment, Coolant System, etc. THREE.

AUTOMATIC SCREW MACHINE, #0C Brown & Sharpe, Cap. 9/16", Slotting Attachment, Coolant System, etc. TWO.

AUTOMATIC SCREW MACHINE, #2 Brown & Sharpe, Cap. 1", Collet, Collet Chuck, toolposts, Coolant System, etc. FOUR.

AUTOMATIC SCREW MACHINE, #2G Brown & Sharpe, Cap. 1", 2 h.p. 220/440 volts, Collet, Collet Chuck, Coolant System, etc. THREE.

APRON BRAKE, Cerweco 8' x 14 gauge. All-Steel. Hand Type.

BORING MILL, Betts 100" Vertical.

BORING MILL, Bullard 54" Vert. Spiral Drive.

BUFFER & POLISHER, U. S. Electrical Multi-Speed Double End #95. 5 h.p., 220 volts. Four Speeds up to 2700 r.p.m. Floor model.

BUFFER & POLISHER, Gardner #3DB Double Spindle with independent 7½ h.p. 220/440 volts motors & controls. Timken Bearings.

DRILL, Baker #3I4 Hvy. Pattern High Speed Vertical Boring & Drilling Machine, 7½ h.p. 220/440 motor, #5 taper, 12 feeds, 6 speeds, 12¼" throat, 3" Capacity in steel.

DRILL, Colburn #2 Manufacturing Heavy Duty All Geared Motor Driven, 3 h.p. single phase motor, reversing controls, #4 taper, 10" throat, 1¼" capacity in steel.

DRILL, Leland Gifford #2LH8 Upright Sliding Head Two Spindle, #2 taper, 13" overhang, Independent 220 volts, 4-speed motors, indicated spindle speeds.

DRILL, Natco #12 Multiple Spindle Motor Driven, #1 taper, 3 h.p. 220/440 motor, Arranged for 16 spindles, Rectangular head. With Natco 24" Rotary Table.

STRAIGHT BEVEL GEAR GENERATOR 3" Gleason, Serial #18684, NEW—1942, 220/440 volts motors, Gear Cabinet, Full Set of Index Gears, Segments, Auto-Index Attachment, Pneumatic Chuck Equipment, Cutter Setting Gauges & Segment Setting Gauges, Duplete Cutting Cam & Duplete Feed Cam.

PARTIAL LISTING OF LARGEST STOCK IN THIS AREA

BASE PITCH & SPACE MEASURING MACHINE, #337 Illinois, Late Type—Like New. Capacity—12" diameter gear, 12" between centers. Full Set of Off-Set and Straight Contact Fingers, Dial Indicator, Tailstocks and Leatherette Cover.

GRINDER, Cincinnati #EA, 18" x 30" Hydraulic Cylindrical, Filmatic Bearings, 220 volts motors. Built-in electrics, Hydraulic infeed.

GRINDER, Cincinnati #2 Universal Cutter & Tool, Model #EM, New in 1943, 220/440 volts motors, Cylindrical Grinding Attachment & lot of Equipment.

GRINDER, Bath 10"x25" Motor Driven Universal Surface, 220/440 volts motor with centralized push button controls, Internal Grinder Attachment & Steady Rest, etc.

KEYSEATER, Mitts & Merrill #5 Giant Motor Driven, 220/440 volts motor, Capacity—24" long, 3" wide keyway, Automatic Feed.

LATHE, LeBlond 36" x 30', 220/440 motor, 12 speed head, taper attachment, steady rests, etc.

LATHE, Bridgeford 32" x 16' Q.C.G. Grd. Hd., 110' Centers, 2⅞" hole thru spdle, 15 h.p. 220/440 volts, internal geared faceplate.

LATHE, Hardinge #59 High Speed Second Operation Machine, 1" Collet Cap, Automatic Collet Mechanism, collets, collet chunks, etc. FOUR.

TURRET LATHE, Bardons & Oliver #7 Universal Grd. Hd. Ram Type, Hydraulic Speed Selector, 2½" Cap. 10 h.p. 220/440 motor, With Chuck, toolholders, etc.

TURRET LATHE — Warner Swasey #1-A Model #M-478 Universal 12 Speed Grd. Hd. Hvy. Duty Bar Feed Saddle Type, Cap.—2½", Power Screw Bar Feed & large lot of tooling, 220/440 volts.

MILLING MACHINE, Cincinnati #3 Vert. N.S. Dial Type.

MILLING MACHINE, U. S. #MMI-6 Cam Controlled Automatic Horizontal, #40 taper, Late Type, 220/440 motors, TWO.

MILLING MACHINE, Cincinnati #3 Dial Type High Speed Motor Driven Horizontal, 220/440 motor, Range: 34" x 12" x 20".

MILLING MACHINE, Van Norman #3V Ram Type Vertical, Late Type, 220/440 motors, Also stub arbors, arbor, vise, collets & cutters.

PLANER, Gray 38x38x14'. Four hds.

POWER PRESS, Bliss #84 S.S.S.A. 86 tons, 10" Stroke, 20" between uprights.

POWER PRESS, Bliss #75½ S.S.S.A. 120 tons, 5½" Stroke, 24" between uprights.

POWER PRESS, Bliss #3A S.S. Dble. Crank S.A. Grd. 45 tons, 4" stroke, 20" between uprights, Power Press, Niagara #3B Back Flywheel, 67 Tons, 3" stroke, 10" shut hgt. 12"x14" hole thru bed, 28"x 18" bed area.

WHEEL PRESS, Niles B & Pond 200 Tons Hydraulic Horizontal, 48" between strain bars, Two Plunger Type, 7.5 h.p. 220/440 motor.

POWER PRESS, Bliss-Consolidated #77 Open Back Gap Frame Sgle. Crank Sgle. Action Back geared, 175 tons, 10" stroke, Bed area—24" x 42", With Roll Feed and Roll Straightener.

POWER PRESS Fermonte #2S Double Crank Sgle. Action, S.S. Geared, 85 tons, 1¾" stroke, Bed area —61½" x 27⅝".

POWER PRESS — Bliss - Consolidated #163 - B Straight Side Dble. Crank Single Action, 45 tons, 6" stroke, Bed area—24" x 41", 15 h.p. 220 motor.

GUARANTEED TOOLS

16"x60" PRATT & WHITNEY Toolroom Lathe
20"x62" cc AMERICAN 12 Speed Timken Head Lathe, rapid traverse
24"x24' LODGE & SHIPLEY Lathe, 18' cc, taper, chucks, etc., MD
48"x30' NILES Heavy Duty Geared Head Engine Lathe, new 1939, taper, steady rests, MD
4' HAMMOND Jackknife Radial, 1942, electric tapping attachment
36" BULLARD New Era Vertical Turret Lathe
84" CONSOLIDATED COLBURN Vert. Boring Mill, 2 swivel heads, rapid traverse, AC—MD
No. 3 CINCINNATI (Dial Type) Plain Mill, Vert. Head, 1941
No. 9A MARVEL Automatic Hacksaw, 10"x10" gap, bar feed, MD
No. 512 NIAGARA Straight Side Press, 280 tons, MD
24" GOULD & EBERHARDT Shaper, rapid traverse, power downfeed, factory motor drive
10" PRATT & WHITNEY Vertical Shaper, MD
10'—3/8" Pyramid Bending Rolls
No. 3½ BAKER Keyseater, cuts 4½" keyways, AC-MD
36"x30' bed LODGE & SHIPLEY Selective Geared Head Lathe, raised to swing 50", 22' centers, 2 carriages
6"x36" NORTON Type C Cylindrical Grinder, 1942
No. 7 FELLOWS Gear Shaper, factory rebuilt
No. 4A WARNER & SWASEY Turret Lathe, quick change gearbox, full length leadscrew, 1942

O'CONNELL MACHINERY CO.
1925 NIAGARA ST. BUFFALO 7, N. Y.

FOR SALE — 1st Class Condition

LEBLOND LATHE, Size—25" swing over compound, 31" swing over bed, 96" Between Centers.

Motor—3/60/220-440 Volt, Age 3 years. Used approximately 150 hours.

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MINNEAPOLIS, MINN.

LATE MODEL MACHINE TOOLS . .

AUTOMATICS

10" Bullard Mult-Au-Matic, 6 Spdl. 1941.
1⅝" Greenlee, 6 spindle. 1942.

BOLT MACHINES

No. 500C Manville Thread Roller. Latest.
No. 250C Manville Header, SSSD. Latest.

BORING MACHINES

62" King Vertical. 1942.
47A & 48A Heald Single End. 1943.
No. 46B Heald Single End. 1940.

DRILLS, RADIAL

4'11" Canedy-Otto. 1943.
6' 13" American Hole Wizard. 1941.

GEAR EQUIPMENT

No. 6 Gleason Baracycle. 1941.
No. 6 & 17 Gleason Testers. 1943.
8" Red Ring Internal Shaver. Late.
No. OCL Red Ring Shaver. 1942.
No. 645A3, 615A & 61A Fellows. 1944.
No. 712 & 72 Fellows Shaper. 1943.
Vinco Spline & Gear Grinder 1942.
Red Ring Univ. Checker.

GRINDERS, CYLINDRICAL

25" x 48" Landis, Crankshaft. Like New.
16" x 36" Cincinnati Plain. 1942.
12" x 30" Landis Univ. 1941.
10" x 72" Landis Plain. 1942.
10" x 18" Norton Plain. 1942.

GRINDERS, INTERNAL

No. 72A3 & A5 Heald Rotary. 1943.
6"x18" Norton Universal Hydraulic. 1941.

LATHES, ENGINE

42" x 192" Axelson. 1942.
26" x 12' LeBlond. 1942.
27" x 96" LeBlond. 1942.
14" x 30" Bradford. 1943.

LATHES, PRODUCTION

No. 2A LAS "Duomatic". 1943.
8" x 108" Lo-Swing Semi. Auto. 1942.
Model 16 Sundstrand. 1943.
14" x 42" Monarch "Magna-Matic". 1941.

LATHES, TURRET

42" x 36" Bullard Vertical. 1943.
No 3A Warner & Swasey. 1941.
No. 4A Warner & Swasey, M.D.
No. 1 & 8½" x 24" Acme Univ. 1943.
No. 2 & 4 Warner & Swasey. 1942.
No. 3, 5 & 7 Bardons & Oliver. 1942.

MILLS, PLAIN

No. 2B Brown & Sharpe. 1941.
No. 5 Cincinnati. 1943.
No. 36 Van Norman. 1942.
No. 28 Van Norman. 1942.

MILLS, PRODUCTION

No. 2-24 Cin., Plain and R. & P. 1943.
No. 1-14 & 2-30 Kent Owens 1943.
M-18 Kearney & Trecker. 1943.
No. 4236 Kearney & Trecker. 1942.
No. 2-36 Cincinnati Duplex, R. & P. 1942.
No. 2-36 Cincinnati Hydromatic. 1942
No. 1-18, 3-18 & 5-24 Cincinnati. 1942.

MILLS, THREAD

12" x 54" Lees Bradner. 1943.
6" x 36" Lees Bradner. 1942.
4" x 8" Hanson Whitney. 1942.

MILLS, UNIVERSAL

No. 2MH Cincinnati. 1942.
No. 2H Milwaukee. 1942.
No 28U Van Norman 1942.

MILLS, VERTICAL

No. 2K & 3H Milwaukee. 1942.
No. 2 Cincinnati. 1942.
No 1 Cleveland 1942.

PRESSES

50 Ton Denison. Hyd., Str. 1942.

SHAPERS & PLANERS

20" Cincinnati Plain. Late.
25" Smith & Mills Univ. 1945.

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MACHINE TOOLS FOR SALE

Item No.

BORING MILLS

1-47 Foote Burt Horizontal Drilling & Milling Machine. Table size, 60"x72"; 4" Spindle; Electrics 60/3/550/10; Serial No. 14232-42.

CUTTING MACHINES

4-34 Campbell Horizontal Wet Abrasive Cutting Machine. Model 302; Electrics 60/3/550/7½, Serial No. 172.

DRILLS

7-39 Allen No. 2 Motor Spindle, 4 Spindle Drilling Machine. Type MSPF-Power Feed; 12" overhang; Electrics 60/3/550/1; Serial No. 17817.

8-19 Allen No. 2 Vertical Motor, V-Belt Drive Drilling Machine. 4 Spindle; Type KH-hand feed; 7" overhang; Electrics 60/3/550/½; Serial No. 16276.

9-24 Barnes Drill Vertical Single Spindle Heavy Duty Drilling Machine. No. 242; 2" capacity in solid Steel; Electrics 60/3/550/10; Serial No. 2459.

GRINDERS

17-37 Jones & Lamson Universal Automatic Thread Grinding Machine. Swing 6"; Centers 36"; Electrics 60/3/220-440/5; Serial No. SBG-7001.

18-3 Landis Cylindrical Grinding Machine (Hydraulic). Type C Plain; Swing 10"; Centers 36"; Electrics 60/3/220-440/15; Serial No. 22560.

19-51 Sellers Full Universal Tool Grinder; Type 4T; Capacity ¼" to 1½" x 2"; Electrics 60/3/550/3; Serial No. 03-1090.

Item No.

JIG BORER

20-50 Kearney & Trecker; Model A Autometric; Electrics 60/3/220/440; Serial No. D-4140.

LATHES, TURRET

32-33 Bardons & Oliver No. 5 Universal Turret Lathe. Electrics 60/3/550/7½; Serial No. 15701.

33-32 Bardons & Oliver No. 7 Universal Turret Lathe. Electrics 60/3/550/10; Serial No. 15707.

34-6 Gisholt No. 3R Universal; Elec. 60/3/440/15; Serial 2919-40.

MILLING MACHINES

36-61 Brown & Sharpe No. 12 Plain. Electrics 60/3/220-440/3; Serial No. 3391.

37-62 Brown & Sharpe No. 12 Plain. 60/3/220-440/3; Serial 3363.

39-17 Cincinnati Horizontal Plain. No. 3 Dial Type; Speed 24-600; Vertical Head; Electrics 60/3/550/7½; Serial No. 2A3P1C-14.

40-12 Cincinnati Vertical. No. 2 Dial Type; Speed 20-500; Electrics 60/3/550/5; Ser. 2A2V1K-215.

41-15 Cincinnati Vertical. No. 2 Dial Type; Speed 20-500; 16" Rotary Table; Electrics 60/3/550/5; Serial No. 2A2V1L-82.

42-52 Cincinnati Vertical. No. 2 Dial Type; Speed 20-500; Attachments; Electrics 60/3/550/5; Serial No. 2A2V1K-214.

43-10 Cincinnati Vertical. No. 4 Dial Type; Speed 18-1300; Electrics plate miss.; Ser. 4A4V1J-191.

44-18 Cincinnati No. 1-12 Plain Automatic. Electrics 25/3/550/3; Serial No. 2F1P1J-435.

Item No.

45-20 Cincinnati No. 1-12 Plain Automatic with Vise; Electrics 60/3/550/3; Serial No. 2F1P1J-117.

46-41 Kearney & Trecker Milwaukee Vertical. Model 3H; Speed 20-1000; Electrics 60/3/550/7½; Serial No. 292952.

47-27 Kearney & Trecker Milwaukee Vertical. Model 3H; Speed 20-1000; Electrics 60/3/550/7½; Serial No. 41-2875.

48-40 Kearney & Trecker Milwaukee Vertical. Model 3KM; Speed 15-750; Electrics 60/3/440/10; Serial No. 9-3164.

49-7 Reed-Prentice Vertical Miller & Die Sinker. Model No. 4; Speed 30-1170; Electrics 60/3/550/5; Serial No. 21395.

50-55 Reed-Prentice Vertical Miller & Die Sinker with helical gear drive to Spindle. Model No. 5; Attachments; Electrics 60/3/550/7½; Serial No. 20930.

51-28 Lees Bradner Thread Miller. Model HT Heavy Type 12"x54"; 60/3/550/3; Ser. HT-1018-5862.

ROLLS, BENDING

53-57 Buffalo Forge Co. Size: No. ½; 60/3/550/5; Order No. P1853.

SHAPERS

56-30 Gould & Eberhardt 24" Universal with vise; Electrics 50/3/220-440/7½; Serial No. 2159A3.

57-22 Vernon 12", Electrics 60/3/550/1; Serial No. V8204.

SHEAR, ROTARY

64-BB Quickwork Shear No. 60 built by The Quickwork Co., St. Marys, Ohio. Serial #6S6X53.

SWAGING MACHINES

60-56 Langelier 4" Die, Model E, Hydraulic. Electrics 60/3/550/5.

61-53 Langelier 5" Die Hydraulic. Model H6; Electrics 60/3/550/20; Serial No. 26600.

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HIGH SPEED TOOL BITS

3/16"	square x 2"	long	$ .05 each	1/2"	square x 4"	long	.50 each
1/4"	" x 2½"	"	.10 "	5/8"	" x 4½"	"	.75 "
5/16"	" x 2½"	"	.15 "	3/4"	" x 5"	"	1.00 "
3/8"	" x 3"	"	.25 "	7/8"	" x 6"	"	1.25 "
7/16"	" x 3½"	"	.35 "	1"	" x 7"	"	1.50 "

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WOODWARD 48x48x12' Double Housing, two rail heads, one side head, AC belted motor drive

WOODWARD, 30x30x12' Double Housing, two rail heads, one side head, V-belt motor drive

GRAY, 36x36x10' Double Housing, two rail heads, belt driven

GRAY, 42x30x10' Double Housing, Widened Pattern type, two rail heads, one side head

FLATHER, 56x36x10' Double Housing, Motor driven, two rail heads

GRAY, 24x24x8' Double Housing, motor driven, single head on cross rail

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No. 25T G. & L. 2½" table Hor. Mill, 1942

3" Univ. Table Mill, 40" vert., 72" hor., '43

4" Univ. Table Mill, 60" vert. 98" hor., '43

36" & 42" Kings Side Hd. Vert. Mills, '43

Nos. 1A & 3 W. & S. Turrets, bar & chuck

Nos. 3 & 2MH Cinci. Pl. Dial Millers, late

No. 36 Van Norman Pl. Miller, ram, '43

No. 2G Kempsmith Univ. Miller, 1943 (3)

No. 2416 Keller Duplicator, 3 dim., 3 spin.

No. 9J Gorton Elec. Duplicator, 1944

Gear Cutter, No. 13 B. & S., spur & bevel

30"x120" con. Axelson Lathe, T.A.

30"x120" Hanchett Pianto Surface Grinder

No. 2 Stand. K. & T. Univ. Miller, Timken

Gear Cutter, No. 13 B. & S., spur & bevel

12"x48" Hanchett Vert. Spin. Surface Grinder

96"x96"x24' N.B.P. Planer

8' 17" col. Carlton Radial, M on arm

14"x54" con. Monarch, T.A., 1945.

8' Sturdybender Press Brake, 60 ton

BENNETT MACHINERY CO.

30 Church St., New York 7, N. Y.

MILLERS

2H. Milwaukee Vertical, 1943.

3H. Milwaukee Plain, 3-arbors, 1945.

5H. Milwaukee Plain. Vert. Hd., Vise, 1942.

RADIAL DRILLS

(motors-on-arms) 1942

5'x17" Carlton, motor 250 V. DC. with Motor Generator Set 3/60/220.

4'x11" American, 24-speeds, Triple Purpose.

BORING MILL & LATHE

73" Niles, Vertical, 2 Hds., AC. Motor.

48"x24' centers Lathe, Geared Hd. AC. Motor.

18"-18½"x30" Bradford 12-speed G.H., T.A. (near new)

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VERTICAL DRILLING and BORING MACHINES

W. F. & JOHN BARNES VERTICAL DRILLING & BORING MACHINE, 16 spindles driven from base. Original cost over $20,000.00. Practically new. Very late type.

Special Price $3,500.00

Model #28 EXCELLO VERTICAL DRILLING & BORING MACHINE, six spindles, serial No. 22584. Excellent condition.

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No. 0 Sundstrand Rigidmill, m.d., latest
No. 0B Cincinnati Model EA, m.d., latest
No. 12 Brown & Sharpe, md.
No. 1-12 Cincinnati, m.d., latest
No. 2-18 Cincinnati, m.d., with rise and fall, latest
No. 2-24 Cincinnati, m.d., latest
No. 2-24 Cincinnati, m.d., with rise and fall, latest
No. M24 Kearney & Trecker Production, m.d., latest
No. 4-48 Cincinnati Plain Hydromatic, m.d., latest
No. 4-48 Cincinnati Duplex Hydromatic, m.d., latest
No. M30 Milwaukee Simplex, m.d., latest
No. 34-36 Cincinnati Duplex Hydromatic, m.d., with tracer control, latest
No. 34-36 Cincinnati Plain Hydromatic, m.d., with tracer control, latest
No. 34-60 Cincinnati Plain Hydromatic, m.d., latest
No. 56-72 Cincinnati Duplex Hydromatic, m.d., latest
No. 56-90 Cincinnati Duplex Hydromatic, m.d., latest
Type P Ohio Mfg., m.d.
Sundstrand Rigidmill, m.d.
4" Pratt & Whitney Spline, m.d.
No. 33 Kempsmith Mfg., s.p.d.
18", 24" Cincinnati Plain Automatic, m.d.
24", 48" Cincinnati Duplex Automatic, m.d.
30"x30"x12" Ingersoll Slab Milling Machine, 2 heads, m.d.
48"x48"x20" Ingersoll Fixed Rail Milling Machine, for tank work
72"x6' Ingersoll Single Horizontal Spindle Traveling Housing Milling Machine, m.d.

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No. CT-36 Lees-Bradner, m.d., latest
No. CT-54 Lees-Bradner, m.d., latest
Hall Planetary, m.d.
4½x12", 6x14", 6x20", 6x40", 6x80" Pratt & Whitney
10x24" Hanson Whitney, m.d., latest
10x40" Hanson Whitney, m.d.

HAND MILLING MACHINES

United States, vee belted, m.d.
No. 1 Kent Owens, m.d.
Atlas Model MF Bench, m.d.
No. 1 Standard, m.d.
No. 2 Productomatic, m.d.

PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
No. 1A Milwaukee, m.d.
No. 1M Cincinnati, m.d.
No. 1 Special Plain Kearney & Trecker Milwaukee, m.d.
No. 1½, 2, 3 Cincinnati, cone
No. 2B Brown & Sharpe, m.d., latest
No. 2 Cincinnati N.S. Dial, m.d., latest
No. 2 Bickford, m.d.
No. 2H Milwaukee, m.d.
No. 2HL Milwaukee, m.d., latest
No. 3 Cincinnati N.S. Dial, m.d., latest
No. 3 Cincinnati H.P., m.d., p.r.t., late type
No. 3B Brown & Sharpe, m.d., late
No. 3, 4 Kempsmith Maxi-Miller, m.d.
No. 3B Milwaukee, m.d.
No. 3 Van Norman Duplex, s.p.d.
No. 4 Cincinnati H.P., m.d.
No. 4 Ohio, cone
No. 5 Cincinnati, rect. overarm, m.d.
No. 5 H.D. LeBlond, s.p.d.
No. 5B Brown & Sharpe Heavy, m.d.
No. 4K Milwaukee, m.d., late type

UNIVERSAL MILLING MACHINES

No. 1B Milwaukee, m.d.
No. 2A Brown & Sharpe, s.p.d.
No. 2 Cincinnati Medium Speed Dial, m.d., latest
No. 2 Cincinnati, cone, motorized
No. 2M Cincinnati, m.d.
No. 2 Kempsmith, cone
No. 3 Kempsmith, cone
No. 3A Brown & Sharpe, s.p.d.
No. 4A Brown & Sharpe, m.d.
No. 4 Cincinnati H.P., m.d.
No. 4G LeBlond, s.p.d.

VERTICAL MILLING MACHINES

No. 0B Cincinnati, m.d., latest
No. 2M Cincinnati, m.d.
No. 3, 4 Cincinnati H.P., m.d.
No. 2, 3, 4 Cincinnati High Speed Dial, m.d., latest
No. 2, 3 Cincinnati Medium Speed Dial, m.d., latest
No. 2H, 4H Milwaukee, m.d., latest
No. 2HL Milwaukee Swiveling Head, m.d., latest
No. 2K, 3K, 4K Milwaukee Dial, m.d., latest
No. 2½B, 3B, 4 Milwaukee, m.d.
No. 3V Toledo, s.p.d.
No. 3V Van Norman, m.d., latest
No. 3VG Rood Prentice, m.d.
No. 5 Brown & Sharpe, cone
No. 5 Rood-Prentice, m.d., latest
No. 6 Becker, cone
Cincinnati Hydromatic, m.d., 2 spindles

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#50 EXCELLO PRECISION THREAD Grinder (Largest made) will Thread 3" shaft any length through spindle, 68" length, 12" dia. on centers.

#124 Gardner Disc Grinder with Rotoclone
Model 30A Fosdick Jig Borer
15" Gleason Quenching Press
32" Gould & Eberhardt Industrial Shaper
500 Ton Erie Hyd. press 40x54", 28" st.
8"x108" LoSwing Lathe, AC motors
1712 Michigan Univ. Relieving Lathe

#17 Gleason Hypoid Gear Grinder for fast precision finishing of hardened spiral bevel, zerol bevel, & hypoid gears & pinions.

2H K & T horiz. miller, double overarm
1404 K & T bed type prod. mill, late type
34/36 Cinc. Hydromatic Duplex mill, late
#4 W & S turret lathe, bar & chucker ser. 757394
Model 2L Gisholt 16" turret lathe
#18 Marvel Roll Stroke Heavy Duty Hyd. hacksaw

96" Ohio Extra Heavy Duty rotary table hand & power feed.

10x36" Cinc. "EA" Hyd. Cyl. Grinder, late

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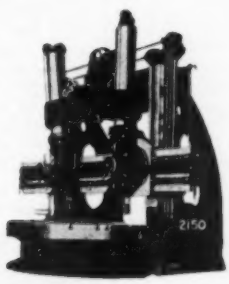

10' BETTS Heavy Vertical Boring & Turning Mill, two swivel heads on rail, ring counterbalances to rams, all geared feeds, power rapid traverse. Arranged for motor drive with motor and control, 230 volt, D. C. Inspect at Albany, N. Y.

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½"x2" No. OG Brown & Sharpe
9/16" Acme Gridley, Model RA6, 6 spindle.
⅞" and 1¼" Cone 4 spindle.
1-1/6" Cleveland Model M.
1⅛" No. 61 New Britain Gridley 6 spindle.
1⅛" Greenlee 6 spindle.
1⅛" Conomatic 8 spindle.
2"x18" Cleveland Model B.
4⅛" Conomatic 4 spindle.
No. 16 New Britain 6 spindle chucker.
No. 454 New Britain 4 spindle chucker.
No. 5 DE 2 Potter & Johnston chucker.
8" Bullard Multomatic 6 station.
14"x18" Monarch Mag-na-Matic.
14"x19" Fay.
1" Economy hopper feed shaver.

BORING MACHINES

100" Niles-Bement-Pond vertical, extra heavy.
52" King vertical.
36" Bullard vertical turret lathe.
5" Jones floor planes type horizontal.
4½" No. 33 Lucas horizontal.
3¾" No. 32 Lucas horizontal.
3½" No. 32 Giddings & Lewis horizontal.
3" No. 31 Lucas horizontal.
3" No. 3A Universal horizontal.
Nos. 47A & 48A Heald Borematics.
No. 42 Heald Borematic.
No. 112 B Ex-Cell-O.
No. DB 2112 Ex-Cell-O.
No. 1212A Ex-Cell-O 4 spindle.
No. 2 Pratt & Whitney vertical jig borer.
Vernon vertical miller or jig borer.
Munson double end horizontal.
No. 4 HH Baker 2 way horizontal.

ENGINE LATHES

10"x20" Monarch model EE
14"x6' Lodge & Shipley
16"x5' Sebastian
16"x10' American.
18"x6' Lodge & Shipley.
18"x8' Rockford.
19"x8' LeBlond.
20"x8' Lodge & Shipley
25"x48" centers LeBlond.
30"x16' LeBlond.
36"x16' Bridgeford.

TURRET LATHES

Nos. 2, 4, 1A & 3A Warner & Swasey
No. 7 Bardons & Oliver.
Nos. 3, 4, 5 3AL & 28" Gisholt.
No. 4 Midland.
No. 6.2 Denver.
24" & 36" Bullard vertical.
3"x36" & 4"x34" Jones & Lamson.
Nos. 2G & 3 Morey.
No. 5 Foster.

MILLERS

No. 2H Kearney & Trecker universal.
No. 3 Cincinnati universal.
No. 3 Van Norman Duplex.
Nos. 2AS & 3B Milwaukee plain.
No. 3 Cincinnati MSDT plain.
No. 3 Ohio plain.
Nos. 2H & 3H Kearney Trecker vertical.
Nos. 2, 3 & 4 Cincinnati dial vertical.
No. 3V Van Norman vertical.
No. 3 Kempsmith Maximill vert.
No. 4 Cincinnati H.P. vertical.

SHAPERS & PLANERS

16", 20", 24" & 28" G&E shapers.
20" x 24" Gemco univ. shapers.
24" Columbia univ. shapers.
6" Pratt & Whitney vertical shaper.
30"x24"x6' Liberty openside planer.
36"x36"x8' Gray planer.

MISCELLANEOUS

BALER, No. 23P-60 Logeman hydraulic.
BROACH, 10T, 36" stroke Colonial surf.
DRILLS, 121, 217, 314A, 315, 30H Baker.
GEAR HOBBERS, 8H, 12H, 16HS, 18H G&E.
GRINDER, 12"x36" Cincinnati univ.
HAMMER, No. 5N Nazel air.
HONER, No. 307 Barnes.
LAPPER, No. 26F Norton Hyprolap.
PROFILER, No. 12B Pratt & Whitney.
PRESS, 1000 ton Baldwin hydraulic
TAPPER, Baush radial arm.
TAPPER, No. 1 Bakewell.
THREADER, 1½", No. 11 Murchey.
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JONES & LAMSON NO. 5 RAM TYPE UNIVERSAL, Late, hole through spindle 3" swing over bed 21½", max. turning length 29½", bar feed with tooling.
JONES & LAMSON NO. 7A SADDLE TYPE HOLLOW HEX UNIVERSAL, Late, hole through spindle 3", swing over bed 21¼", max. turning length 36⅝", bar feed, chucking, tooling.
WARNER & SWASEY NO. 1A PRESELECTOR HEAD DUTY SADDLE TYPE HOLLOW HEX UNIVERSAL, Late, hole through spindle 3-1/16", swing over bed 18", max. turning length 35", bar feed, chucking, and quantity of tooling.
WARNER & SWASEY NO. 3A HEAVY DUTY SADDLE TYPE HOLLOW HEX UNIVERSAL, Late, hole through spindle 4⅜", swing over bed 24½", max. turning length 44¼", bar feed, chucking, full length lead screw, quantity of tooling.

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BROWN & SHARPE #3 DIAL TYPE HI-SPEED, wkg. table 62½"x15", range 34"x12"x20", rpd. traverse, Late.
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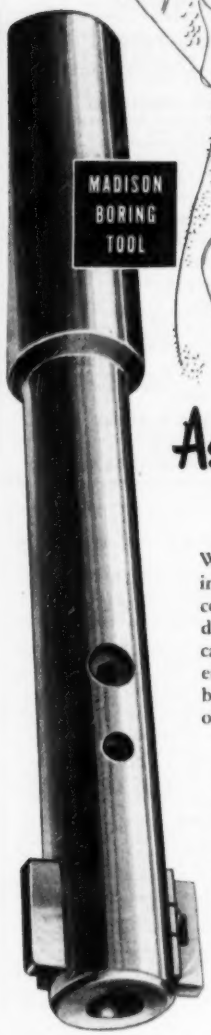

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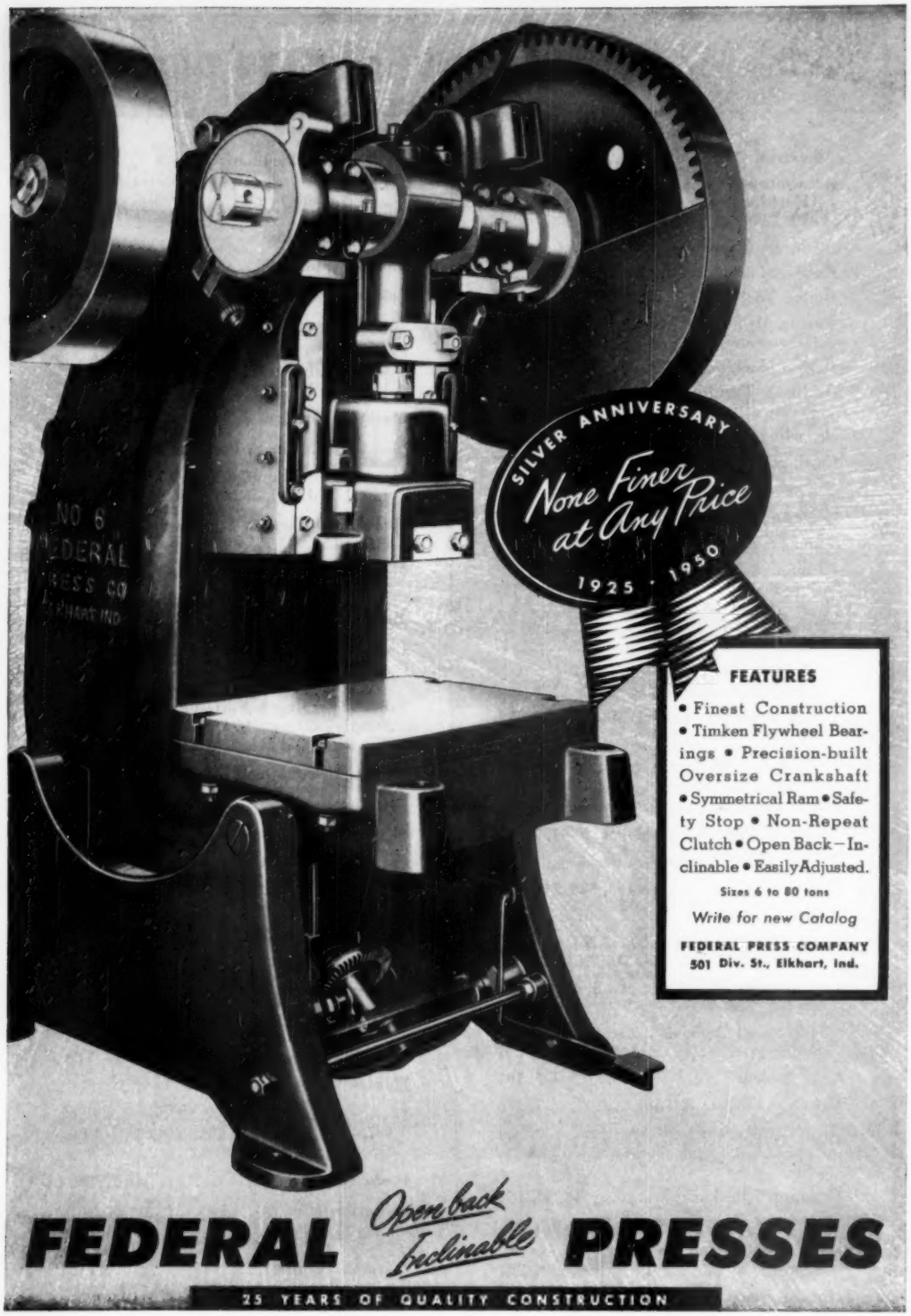
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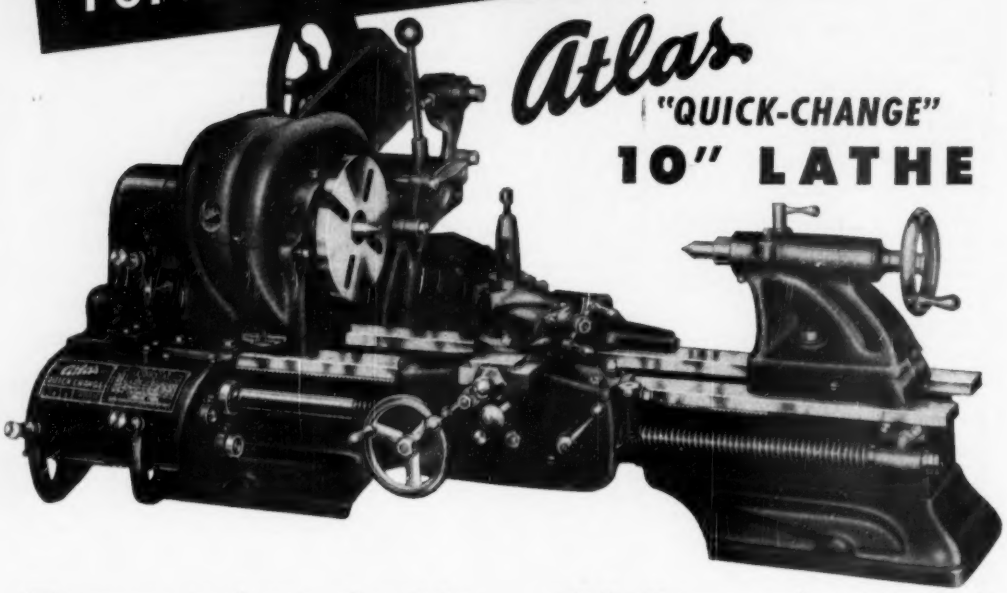
For Every Type of Machining



Atlas "QUICK-CHANGE" 10" LATHE

The greater speed range of an Atlas lathe adds to its value in your shop. From a low of 28 RPM it goes to 2072 RPM, with a standard 1725 RPM motor, giving you correct speeds for every lathe operation in metals, woods, and plastics.

Timken tapered roller bearings in the headstock *(exclusive with the Atlas among low-cost bench lathes)* maintain spindle alignment, and minimize friction and wear on high-spindle-speed work.

Greater speed range and Timken bearings are but two of the many standard extra-value features incorporated in Atlas lathes to make them more useful in tool room, experimental, maintenance, and production work. Send for latest catalog with complete details.

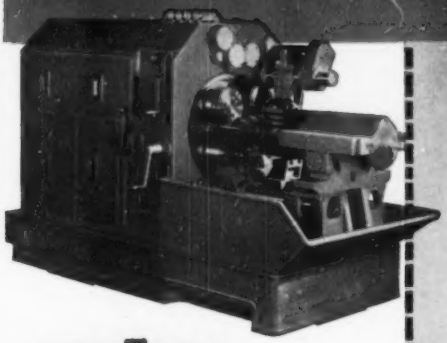
ATLAS PRESS CO.

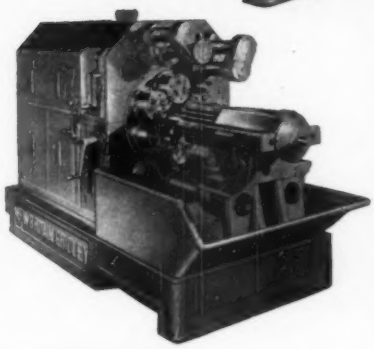
1004 N. Pitcher St., Kalamazoo, Mich.

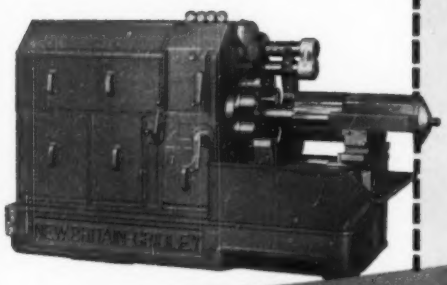
Atlas Power King

MATCHED PRECISION TOOLS FOR WOODWORKING AND METALWORKING

SPECIAL FEATURES...
mean better production methods







NEW BRITAIN *Automatic* 4-6-8 Spindle Chuckers

HYDRAULIC CHUCKING for simple positive control and rapid action. Chucking pressures automatically reduced in finishing positions, if necessary to prevent distortion.

FLAT CROSS SLIDES AND SWINGING TYPE FORMING ARMS make New Britains equally adaptable to heavy cuts and a wide variety of types of work.

SPINDLE STOPPING MECHANISM positions spindle automatically in loading position, or any other position necessary to perform work requiring a dead spindle. A safety device prevents carrier index before completion of chucking operation.

CARRIER LIFTING, LOCATING AND LOCKING MECHANISMS during index preserve initial accuracy by eliminating both wear and weave from the spindle carrier.

DOUBLE INDEX of spindle carrier with loading in two positions permits finishing both ends of a piece in a single cycle, or two pieces per cycle.

ACCELERATED OR DECELERATED MOTION, separate from turret, changes feed rate of any end working tool for different operations. Drill speeders in all positions.

ANTI-FRICTION BALL BEARING on hydraulic chucking distributor eliminates the wear and heat of metal-to-metal contacts and permits high spindle speed.

OPEN END CONSTRUCTION provides complete accessibility to the tooling area, and easy chip removal.

These important mechanical features are the basis for the adaptability and accuracy of New Britain chuckers and the new, better machining methods they make possible. May we send you the portfolio "It Can Be Done." It contains numerous cost histories showing the results in terms of cost-per-piece and pieces-per-hour. Frequent supplements are issued to those who request this valuable service.

649MJ1

THE NEW BRITAIN MACHINE CO.

NB

NEW BRITAIN

Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

DeVlieg Jigmil bores precision holes in jig time on TIMKEN® bearings

PHOTO below shows the DeVlieg Machine Company's 3-B Jigmil in action at Towmotor's Cleveland plant, boring holes for transmission housings. A fast, precision boring job is insured by the Timken® bearings on the spindle and by the 40 other Timken bearings used throughout the machine.

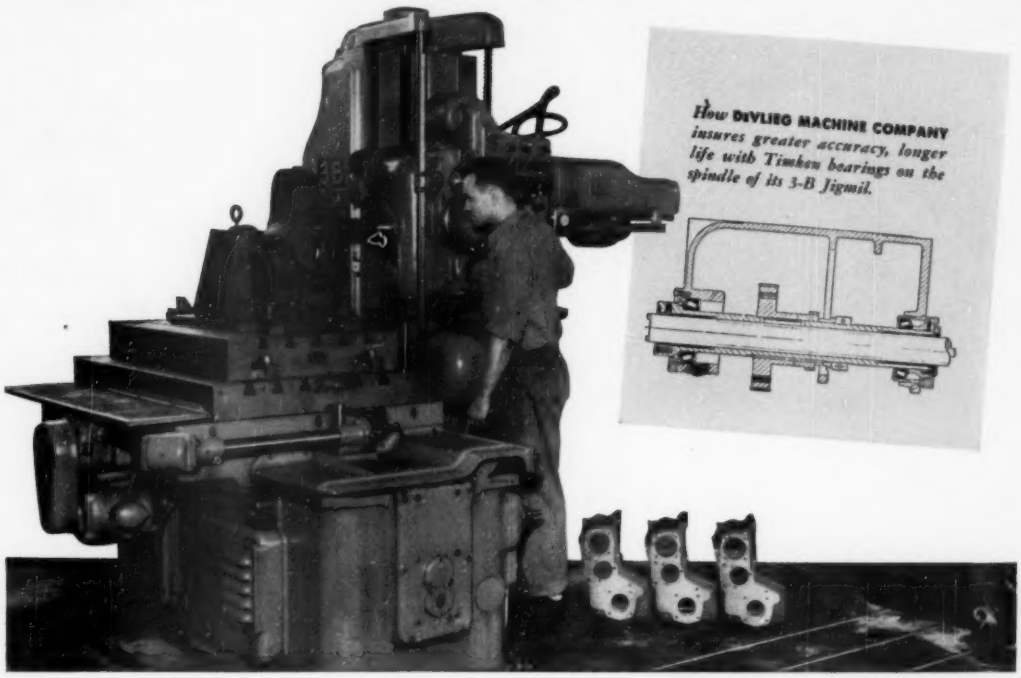
Timken bearings assure greater accuracy and speed by keeping shafts rigid, yet free to rotate with negligible friction. They minimize deflection and end-movement. They lengthen machine life by reducing wear on gears and other adjacent parts.

Because Timken bearings have line-contact between rollers and races, they can carry greater loads. And their tapered construction takes both radial and thrust loads in any combination, permits preloading to any desired degree.

Timken bearings are built for long, tough service. They're made of special analysis Timken fine alloy steel and manufactured to amazing limits of accuracy.

This combination of advanced design and quality construction has made Timken bearings first choice throughout industry. That's why Timken bearings are a valuable added sales feature for your product. Make sure the trade-mark "Timken" is on the bearings you buy. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



How **DEVLIEG MACHINE COMPANY** *insures greater accuracy, longer life with Timken bearings on the spindle of its 3-B Jigmil.*

NEW TIMKEN BEARING CUTS RUN-OUT IN HALF!

Until now, the Timken "Zero" bearing has been the last word in bearing accuracy. Now Timken offers industry the "Double-Zero" bearing—*twice as accurate* as the "Zero"! Maximum run-out of the new "Double-Zero" bearing is only 75 millionths of an inch—*half* the 150 millionths run-out of the "Zero" bearing.

What an opportunity for manufacturers of machines where extreme accuracy is essential! Available in standard single row types, up to 10" O.D. Write for further information.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ◯ **NOT JUST A ROLLER** ⬭ **THE TIMKEN TAPERED ROLLER** ⬭ **BEARING TAKES RADIAL** ◫ **AND THRUST** →◫← **LOADS OR ANY COMBINATION** →✳←